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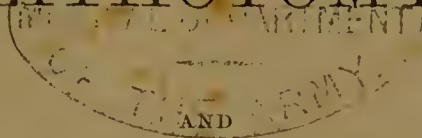
LITHOTOMY

AND

EXTRACTION OF STONE



LITHOTOMY



EXTRACTION OF STONE

FROM THE

BLADDER, URETHRA, AND PROSTATE OF THE MALE

AND FROM THE

BLADDER OF THE FEMALE

BY

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TO

SIR HENRY THOMPSON

SURGEON EXTRAORDINARY TO H.M. THE KING OF THE BELGIANS
PROFESSOR OF CLINICAL SURGERY, AND SURGEON TO UNIVERSITY COLLEGE HOSPITAL.

THIS WORK

IS INSCRIBED, FROM A FEELING OF

ADMIRATION FOR HIS REMARKABLE SKILL

IN

LITHOTRITY AND LITHOTOMY

BY

THE AUTHOR

PREFACE

My endeavour has been to make this work a very complete one, and a record of all the knowledge acquired by the medical and surgical profession, up to the present time, on the subject of urinary calculi, for besides my own considerable experience which has extended to 365 operations by myself, with many others performed under my immediate supervision by my subordinates, I was engaged for two months during last year in the library of the Netley Hospital, in taking notes from all the works bearing on this subject; copious quotations from which I have embodied in the following pages.

No reference has been made to lithotrity, as I, following the general custom of surgeons in India, have never practised it; though, having recently enjoyed the advantage of witnessing Sir H. Thompson's admirable practice, I hope to have the means of popularising the operation in India at some future time.

Though the principal object of this work is to present to the reader a thoroughly practical treatise on the performance of the various operations for the extraction of calculus, and a guide in all the difficulties he may meet with ; yet I have added comprehensive chapters on causation of calculus, and other matters not immediately connected with operative procedures.

LONDON ; *February*, 1876.

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LITHOTOMY AND EXTRACTION OF CALCULI

PART I.—LITHOTOMY

CHAPTER I

CAUSES OF URINARY CALCULI

CHAP. I.

CALCULUS may be looked upon as the same disease as gravel, the difference being that in the former some circumstance has caused the particles of gravel to agglutinate. This was also exactly the opinion of Sir B. Brodie, who writes : —“Whether there be sand or whether there be actual calculi, the nature of the disease is essentially the same.” The predisposing causes of both states will consequently be identical, but before considering them it will be useful to notice the subject of gravel.

The formation of gravel depends upon a tendency in the urine to throw down a deposit previously to its expulsion from the bladder. This probably has, in the great majority of in-

CHAP. I.
—

stances, a constitutional source, though resulting more immediately from mal-assimilation which produces a morbid state of the urine, the nature of this determining the peculiar composition of the gravel. The character of the constitutional source of gravel is very obscure; sometimes we know it to be hereditary, as in gout, but at other times it is less clear what it depends upon, though, since weak and puny children are the most liable to it, it may be allowable to speak of natural debility with impairment of the vital powers as one constitutional cause. This condition, though usually thought to predispose to the oxalic- rather than the lithic-acid diathesis, may I think, be looked upon as likely to cause the latter also, for it is the opinion of some eminent men that both substances are secreted under the same circumstances, and have the same pathological signification. Thus Beale writes:—
“In the same case, at one period, we may find uric acid and urates; after a time these mixed with oxalates; and, lastly, they may give place to a deposit of oxalate alone.”

The only two urinary deposits that will be here treated of are the lithic acid and the oxalic acid, as it is one of these which almost invariably forms the nucleus of a calculus.

Dr Prout describes the immediate cause of the precipitation of lithic-acid gravel to be nearly

always lactic acid secreted in excess, which throws down the lithic acid by combining with the base which retains it in solution.

The cause of the deposit of oxalic acid may be, he says, particularly in the predisposed, the too free use of sugar and the partaking of unwholesome farinaceous matters.

The predisposing causes are the following :

Predisposing causes.

1st. *Hereditary predisposition*.—The hereditary nature of the disease is, the same author writes, very marked in the lithic-acid deposit, the children of gouty and dyspeptic parents, and of those suffering from lithic-acid diathesis, or other urinary diseases, being especially liable to it.

2nd. *Sex*.—Urinary deposits are more common in the male than in the female, one cause of the comparative exemption of the latter being the more quiet and temperate lives they lead.

3rd. *Age*.—"Children and elderly people are well known to be more liable to calculi than persons of the middle period of life. In the poorer classes children are afflicted with remarkable frequency ; but in the higher the disorder is more common in the old than young subjects" (Cooper's 'Dictionary,' 7th edition).

Sir H. Thompson says in the third edition of his clinical lectures :—"Among the well-to-do and well-fed, although almost rarely found in childhood, it is almost common at advanced age.

This has been very much overlooked, and its frequency then is greater than most people believe.”

4th. *Climate*.—In those countries where it is prevalent it is most often met with in districts in which cold and piercing winds are prevalent, such as the county of Norfolk; the eastern part of Scotland, from the Firth of Forth northwards; Rohilcund and other districts of the North Western Provinces of India, which lie under the influence of the cold winds blowing off the Himalayas. In very cold and in tropical regions which are not subject to sudden atmospheric vicissitudes, it is said to be rare.

Malarious influence is a predisposing cause both of lithic-acid and oxalic-acid deposits. With reference to the former Dr Prout writes:—“Malarious influence in warm climates does not seem to lead to lithic deposits; but in cold climates, where it operates more especially by inducing rheumatism and ague, it may be considered, especially when concurring with other causes, as a fertile source of such depositions.” “Among *exciting* causes of the oxalic-acid diathesis,” he says, “one of the most striking I am acquainted with, as before observed, is a residence in a damp and malarious district. In such a district the predisposed seldom escape, and even those who are not predisposed are apt, after a time, to become more or less affected.” The

way in which cold winds cause urinary deposits is by checking the action of the cutaneous vessels, and consequently the excretion of lactic acid, which, this writer says, failing to find an exit with the perspiration, is diverted to the urine.

5th. *Water*.—It has been repeatedly observed that urinary deposits are common in persons living in limestone districts, owing to derangement of the digestion caused by the use of hard water. The hurtfulness of such waters is spoken of by Dr Prout, who writes :—" They operate in various ways and produce very different effects in different diseases and constitutions ; but their general influence in all forms of urinary deposition is, according to my observation, very unfavorable."

6th. *Food*.—It has been frequently noticed that, in those parts of a country where gravel is a common disease, the food is in fault ; thus, in Norfolk, coarse dumplings are a usual article of diet, and in the North Western Provinces of India, where the disease is prevalent, the ordinary diet of the population is heavy unfermented bread, made from the admixture of several kinds of cheap grain.

7th. *Occupation*.—Sedentary employment is probably a predisposing cause, as it is thought that seafaring people and soldiers who lead an active, out-of-doors life are much less liable than

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others to the affection, though as yet this does not appear to be a well-ascertained fact.

8th. *Rank of life*.—Mr Gross, the American surgeon, is of opinion that the disease is much more common among the poor than the rich, and says:—"Upon what this difference depends is not positively ascertained; the probability is that it is mainly due to derangement of the digestive organs, engendered by the use of unwholesome food, by irregular habits, want of cleanliness, intemperance, and deficient clothing."

9th. *Diseases of the liver*.—Dr Beale has brought to notice that a deposit of lithic acid is common in diseases of the liver, and even in temporary congestion only of that organ. The reason of this is that, the liver not performing its excreting functions efficiently, the kidneys are called upon to compensate for its inactivity by forming so large a quantity of lithic acid that it can no longer be eliminated in solution, but is deposited in its crystalline forms in some parts of the urinary passages.

10th. *Diseases of the skin*.—While diseases of the liver give rise to lithic-acid deposit, skin diseases, particularly impetiginous or allied affections, appear to predispose to a deposit of oxalic acid.

Predisposing causes in
Norfolk.

The correctness of the above as predisposing causes is borne out by Mr Cadge, of the Norfolk

Hospital, who is of opinion that the local influences which contribute to renal and vesical calculus in Norfolk are the universal consumption of malt liquors, the constant daily use of exceedingly hard drinking water, and the accumulated effect of hereditary predisposition.

As the exciting causes act by leading to the Nucleus. aggregation of the particles of gravel, the manner in which this takes place and other matters connected with the formation of the nucleus will first be dwelt upon.

Dr Beale's views on the formation of the Dr Beale's views. nucleus is that in many cases it is a microscopic calculus, and that it depends on the concentration of the fluids of the body leading to the deposition of the least soluble substances in a solid form ; and he supports this opinion by the frequency of cases of calculous disease in those who have suffered from cholera.

Microscopic calculi are also found in cases of phosphate-of-lime calculi which occur in the kidney, Beale says, "mixed with a considerable quantity of pulverulent matter like fine sand. Each particle of this is found, upon microscopical examination, to consist of a minute calculus, containing a certain quantity of organic matter, probably mucus and disintegrated epithelium, for its nucleus."

This author says :—" Any solid matter may

form the nucleus of a calculous concretion—inspissated mucus from any part of the urinary organs, crystals which have been deposited, cells of epithelium, ova of entozoa, pieces of fibrin and small clots of blood, foreign bodies which have been introduced from without.”

The nucleus of the microscopic calculus of oxalic acid does not depend, like that of the phosphatic calculus, on mucus or epithelium; but consists of crystals of oxalic acid which have aggregated in the uriniferous tubes, and finally find their way into the pelvis of the kidney as a nucleus where it may become entangled in the mucus of the mucous membrane, and then further increasing in size, pass down the ureter into the bladder, and if the urine contain much oxalate of lime may receive additions which will render it too large to escape by the urethra.

Dr Beale’s opinion is that oxalic acid, especially in its form of dumb-bell crystal, is the substance which is generally deposited in the uriniferous tubes, and forms the microscopic calculus. He writes:—“Many small uric-acid calculi, which appear to be composed entirely of this substance, will be found on careful examination to possess a nucleus consisting of oxalate of lime, and not unfrequently well-defined dumb-bell crystals may be obtained From recent analyses I have made I have been led to the conclusion that the dumb-

bell crystals form the nucleus around which the uric acid is deposited, more frequently than any other substance. . . . A microscopic calculus may consist of only two dumb-bells. . . . These minute calculi remain probably for some time in the kidney, and slowly increase until they form the concretions known as hempseed calculi. . . . Having arrived at the bladder the slow deposition of the oxalate may continue, or layers of uric acid or phosphate may be deposited."

This author mentions another fact, in addition to that of the concentration of the fluids, which would lead to a deposition of crystals. He says that a nucleus of the purest calculus contains a certain quantity of animal matter which is deposited with the hard material, and seems to agglutinate the particles, and in this, after the hard matter has been dissolved out, fungi have been found, and he thinks it probable that they developed an action in the fluid around them during their growth which caused the continual precipitation of the soluble matter.

The most frequent mode in which renal con- Dr Prout's views. cretions of oxlate of lime are formed are thought by Dr Prout to be by the influence of cutaneous disease, particularly of the scaly kind. He writes : " In certain states of the system frequently connected with cutaneous disease, and with the presence of oxalic acid, the mucous membranes of

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the urinary organs, and particularly of the kidneys, are disposed to throw off large quantities of lime, either in the shape of carbonate or phosphate of lime or of a mixture of the two. Now, when this is the case, and when oxalic acid, in any state of combination, is at the same time eliminated by the kidney, the formation of the oxalate-of-lime concretion is inevitable; for, from the great excess of lime present, and from the tendency in the urine to alkalescence on such occasions, the oxalate of lime formed, no longer capable of being retained in solution, is deposited in the solid form."

Concrete form of
lithic acid.

Though, according to Beale's theory, lithic acid is generally deposited in the kidney around dumb-bell crystals of oxalic acid, yet it is evident that this is not invariably the case, for Dr Prout states that "about the middle period of life the lithic acid begins to assume the amorphous concrete form, and to give occasion to the formation of renal and vesical calculi; and, lastly, that in more advanced age, there is occasionally a tendency to form numerous small calculi by the deposition of lithic acid round minute nuclei," called pisiform concretions.

Exciting causes.

The following are causes which may lead directly to the formation of calculous nuclei in cases of gravel—

1st. *Congestion or inflammation of the kidneys.*—

The secretion of inflammatory mucus or lymph, the effusion of blood, or desquamation of epithelium from the congested and inflamed mucous lining of the infundibula, pelvis, or other part of the kidneys, may act as a nucleus upon which the crystals of oxalic or lithic acid are deposited, or by which the crystals of those substances become cemented together immediately after secretion, forming a nucleus "soliciting further additions." This state of the kidneys may result from any of the common causes of disease, especially sudden chill, or it may follow injury.

2nd. *Congestion and inflammation of the bladder.*—The congested and inflamed mucous membrane of the bladder may produce adhesive mucus or may lead to the effusion of blood, by which the particles of gravel in the bladder become coherent into a calculus as by a kind of cement; or those substances may, Holmes says, "cause a precipitation of the ordinary salts of the urine around them, viz. the uric acid, urates and oxalates, and thus form stone."

3rd. *Enlargement of the prostate gland and stricture of the urethra.*—These states may prevent the renal calculus, after it has found its way into the bladder, escaping by the urethra, and the urine being supersaturated with the salts of lithic or oxalic acid throws them down upon the calculus, and thus rapidly increases its dimensions. Besides

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which effect, the above-mentioned diseases give rise to phosphate-of-lime calculi as explained by Sir B. Brodie :—"In cases of disordered prostate gland, the mucous membrane of the bladder sometimes becomes inflamed, and the mucus secreted by it deposits phosphate of lime in small masses, and each of these becomes the nucleus of a calculus, but such calculi may unite and form large ones."

4th. *Foreign bodies in the bladder*.—Solid substances introduced into the bladder irritate and inflame its mucous membrane, and even in the most healthy persons soon become encrusted with calculous matter.

Author's observations.

Many of the causes, such as the above, which predispose to and which excite stone in the bladder are fully recognised, but it is not understood why, under apparently the same conditions of climate, water, &c., the disease should be common in some districts of a country and rare in others. For the elucidation of this subject the theory propounded by Dr Beale is very suggestive, and is the direction in which I think an inquiry should be made into it. His views are that the calculus generally commences in the uriniferous tubes by an aggregation of microscopic particles of oxalic acid (he has seen two dumb-bells only forming the starting-point), and that the precipitation of the crystals results both from the concentration of the fluids of the body, as well as from

the development of fungi, the latter having also the property of agglutinating the deposit. If this opinion that a microscopic oxalic-acid nucleus is generally the starting-point of all calculi be a correct one, it would explain why in limestone districts calculus is common, for supposing the microscopic calculus to be present, it could scarcely be washed out of the tubes by the drinking of hard water, as it might be if plenty of soft water were taken, but would be likely to form concretions of oxalate of lime, the affinity of oxalic acid for lime being such that Dr Prout says it takes this earth from all its forms of solution.

The latter author's views, as quoted above, on the influence of cutaneous disease in producing renal concretions of oxalate of lime are worthy of attention, as they may explain the starting-point of the microscopic calculus in some cases. It would therefore be interesting if surgeons who have the opportunity would make observations as to whether skin diseases, especially of the scaly kind, are common in the calculous districts of countries.

CHAPTER II

ANATOMY OF THE PARTS CONCERNED IN LITHOTOMY

CHAP. II.

EVERY surgeon who is likely to be called upon to operate for the extraction of calculus should freshen up his knowledge of the anatomy of the parts concerned in lithotomy by making the following dissections.

Dissection.

Having introduced a staff into the bladder, raise the scrotum upwards, moderately distend the rectum with tow, and place the subject in the lithotomy position.

Make an incision along the middle line of the perineum from the back of the scrotum to the anterior margin of the anus, carry it around the anus, and continue it backwards to the tip of the coccyx.

A transverse incision should now be made along the back of the scrotum from one thigh to the other, a second similar one in front of the anus, and a third in front of the coccyx, the flaps of skin corresponding to these incisions being removed.

The superficial fascia now lies exposed, consisting, as in other situations, of two layers—one the superficial or *fatty* layer, and the other the deep or *membranous* layer. The latter layer will be found to blend in front with the dartos of the scrotum; at the sides to be firmly attached to the margin of the rami of the pubes and ischium, and posteriorly to extend backwards as far as the transversalis perinei muscle, around the posterior margin of which it turns, to be united to the deep perineal fascia upon which the muscle lies.

Deep layer of the superficial fascia.

This attachment of the deep layer of the *superficial fascia* to the deep *perineal fascia* prevents fluid extravasated under the former passing back into the posterior half of the perineum, but allows it to extend into the scrotum and up over the abdomen.

Attachment of deep layer of superficial fascia to deep perineal fascia.

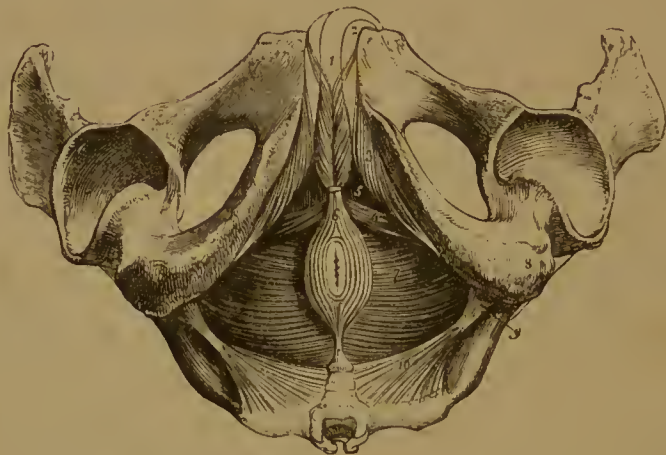
The superficial fascia having been removed on one side, the muscles of the genital region of the perineum will be laid bare; these are the transversus perinei muscle, extending across the back part of the perineal space in front of the anus, the erector penis on the outer side, covering in the unattached part of the crus penis, and the accelerator urinæ on the middle line of the perineum, the posterior fibres of which have an attachment to the anterior layer of the triangular ligament.

Muscles of the penis and urethra.

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Triangular space.

The incisions in lithotomy are made obliquely across the triangular space formed by these muscles (fig. 1), dividing a few of the posterior fibres



(Wilson.)

FIG. 1.—The muscles of the perineum. 1. The acceleratores urinæ muscles; the figure rests on the corpus spongiosum penis. 2. The corpus cavernosum of one side. 3. The erector penis of one side. 4. The transversus perinei of one side. 5. The triangular space through which the deep perineal fascia is seen. 6. The sphincter ani; its anterior extremity is cut off. 7. The levator ani of the left side; the deep space between the tuberosity of the ischium (8) and the anus is the ischio-rectal fossa; the same fossa is seen on the opposite side. 9. The spine of the ischium. 10. The left coccygeus muscle. The boundaries of the perineum are well seen in this engraving.

of the accelerator urinæ muscle, and some of those of the transversus perinei muscle.

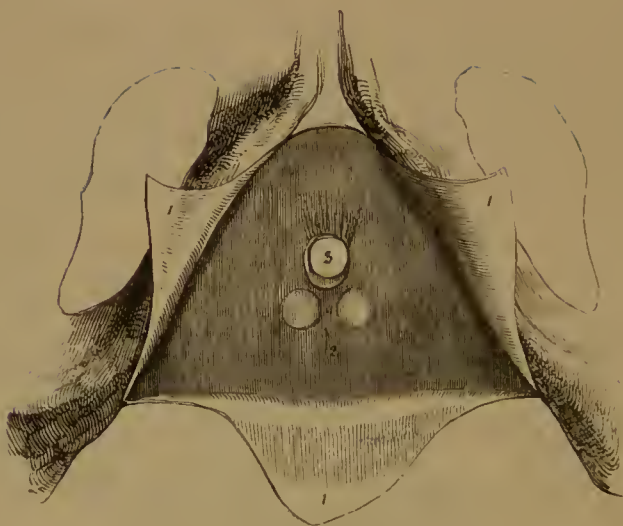
Deep perineal fascia
consisting of two
layers.

A clear idea of the connections of the deep perineal fascia should be obtained, for it supports the parts concerned in lithotomy and constitutes a boundary which prevents extravasation of urine. It forms the triangular ligament by dividing into two layers of fascia which coalesce at the posterior

border of the transversus perinei muscle, but are elsewhere separated from each other by nearly three quarters of an inch. Between the two layers of the triangular ligament thus formed lies the membranous portion of the urethra traversing the interval from above downwards and forwards; the compressor urethræ muscle and a plexus of veins are also here found; at the outer part lying along the border of the ramus of the os pubis the internal pudic artery is situated, and running across the space from without inwards close to the anterior layer, about sixteen lines in front of the anus, is the artery of the bulb, and close behind the bulb Cowper's gland is placed.

In order to display this fascia, clear away the above-mentioned muscles, and on dissecting away the posterior fibres of the accelerator urinæ muscle a dense aponeurotic structure will come into view (fig. 2), which is the anterior layer of the triangular ligament, or, in other words, of the deep perineal fascia, extending across and closing the anterior part of the perineum completely, with the exception of the opening for the passage of the urethra about an inch below the symphysis pubis. It is triangular in shape, attached above by its apex to the subpubic ligament; on each side to the rami of the pubes and ischium, and below at its base, after coalescing with its posterior layer, it joins the deep layer of the superficial fascia

Anterior layer of the
deep perineal fascia.



(Wilson.)

FIG. 2.—The pubic arch, with the attachment of the perineal fasciæ, 1, 1, 1. The superficial perineal fascia divided by a Λ -shaped incision into three flaps; the lateral flaps are turned over the ramus of the os pubis and ischium at each side, to which they are firmly attached; the posterior flap is continuous with the deep perineal fascia. 2. The deep perineal fascia. 3. The opening for the passage of the membranous portion of the urethra previously to the entrance of the latter into the bulb. 4. Two projections of the anterior layer of the deep perineal fascia, corresponding with the position of Cowper's glands.

at the posterior border of the transversus perinei muscle.

Posterior layer of the
perineal fascia or
triangular ligament.

Now remove the anterior layer of the triangular ligament, with all the muscular and other structures which lie in the interval between it and the posterior layer, when the latter will come into view.

Then dissect away this layer of fascia and the strong fibres of the levator ani muscle covering the sides of the prostate will be seen, some of which are always divided in lithotomy.

Lastly, dissect off the anterior part of the

levator ani muscle, so as to expose to view the prostate gland enclosed in its sheath of fascia.

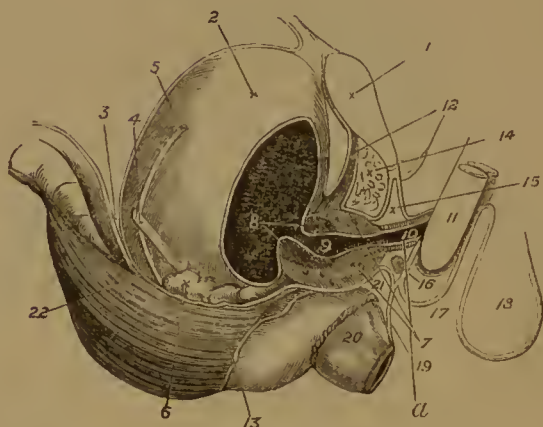
The only part of the triangular ligament incised in lithotomy should be the lower part of the anterior layer, and the knife should be made to enter the membranous portion of the urethra between it and the posterior layer without wounding the latter. Any such wound would be dangerous, and must be carefully guarded against, as it would open up the recto-vesical fascia which is connected with the posterior layer of the triangular ligament, and extravasation of urine would be the result.

Incisions of the triangular ligament in lithotomy.

Accidental wound of posterior layer of triangular ligament.

The liability to this accident is increased if the breech of the patient is not kept in a horizontal position during the operation, but is allowed to tilt upwards: the apex of the prostate gland no longer then remains anterior in position, but being raised, its place is taken by some part of the lower surface of the prostate covered with its capsule. A somewhat similar but still more serious malposition of parts takes place when, as sometimes recommended in books, the staff is made to project underneath the skin of the perineum, for the prostatic portion of the urethra may then be displaced in such a way as to cause the lower surface of the prostate to face anteriorly, or the gland itself to come to be placed underneath the membranous portion of the

urethra in the line of the incision usually made into that part. Figs. 3 and 4, copied from a



(Wilson.)

FIG. 3.—A side view of the viscera of the pelvis, showing the distribution of the perineal and pelvic fasciæ. 1. Symphysis pubis. 2. The bladder. 3. The recto-vesical fold of the peritoneum, passing from the anterior surface of the rectum to the posterior part of the bladder; from the upper part of the fundus of the bladder it is reflected upon the abdominal parietes. 4. The ureter. 5. The vas deferens, crossing the direction of the ureter. 6. The vesicula seminalis of the right side. 7, 7. The prostate gland divided by a longitudinal section. 8, 8. The section of a ring of elastic tissue which encircles the prostatic portion of the urethra at its commencement. 9. The prostatic portion of the urethra. 10. The membranous portion enclosed by the compressor urethræ muscle. 11. The commencement of the corpus spongiosum penis, the bulb. 12. The anterior ligaments of the bladder formed by the reflection of the pelvic fascia, from the internal surface of the os pubis to the neck of the bladder. 13. The edge of the pelvic fascia at the point where it is reflected upon the rectum. 14. An interval between the pelvic fascia and deep perineal fascia, occupied by a plexus of veins. 15. The deep perineal fascia; its two layers. 16. The Cowper's gland of the right side, situated between the two layers below the membranous portion of the urethra. 17. The superficial perineal fascia ascending in front of the root of the penis to become continuous with the dartos of the scrotum (18). 19. The layer of the deep fascia, which is prolonged to the rectum. 20. The lower part of the levator ani; its fibres are concealed by the anal fascia. 21. The inferior segment of the funnel-shaped process given off from the posterior layer of the deep perineal fascia, which is continuous with the recto-vesical fascia of Tyrrell. The attachment of this fascia to the recto-vesical fold of peritoneum is seen at 22.

(a) Indicating the line of incision into the membranous portion of the urethra quite in front of the apex of the prostate.

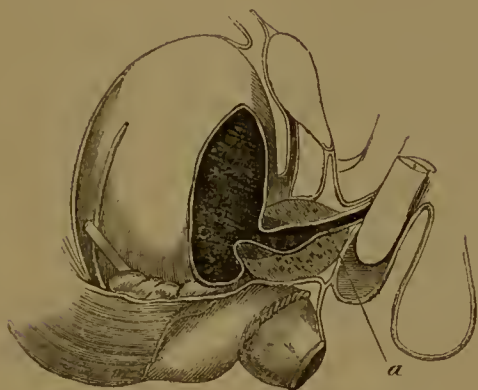


FIG. 4.—Showing displacement of the prostate gland. *a*. Line of incision in lithotomy wounding lower surface of the capsule of the gland, when the prostate is pushed by the staff downwards underneath the membraous portion of the urethra.

figure in 'Wilson's Anatomy,' but the latter, somewhat altered, are here inserted to demonstrate the displacement which would take place: in fig. 3 the body of the patient is supposed to be kept horizontally on the table, and the parts in the most favorable position for operating with safety, the letter *a* indicating the line of incision into the membranous portion of the urethra quite in front of the apex of the prostate; in fig. 4 the prostate is shown pushed downwards by the staff underneath the situation of the membranous portion of the urethra, the letter *a* indicating the line of the incision cutting through the lower surface of the prostate and consequently opening up the recto-vesical fascia.

The surgeon should take an opportunity of

CHAP. II.

Lithotomy on the dead
subject.

performing lithotomy on a subject both with the staff held in a proper manner and also when depressing the prostate, and should in both cases afterwards make the following dissection in order to see the parts of the prostate and neck of the bladder which have been cut: first let him reflect down the penis by dissecting it off from the front of the symphysis pubis above and at the sides, but leaving it attached below; next cut through the pubic arch at each side of the symphysis pubis, making the incisions meet below so that the included piece of bone may be detached; lastly, slit open with a pair of scissors the neck of the bladder and the whole length of the urethra, so as to lay open the canal through its entire length.

Pelvic fascia.

In order to examine the pelvic fascia, the following lateral section of the pelvis should be made:

Open the abdomen, and having turned aside the intestines saw through the os pubis in a line with the tuberosity, and also through the sacroiliac articulation, keeping the edge of the saw slightly inclined away from the spine so that the section may be made into the great ischiatic notch, and if while doing so the left leg is abducted, the separation of the bone will be facilitated; lastly, the loosened portion of the innominate bone must be gently pulled down,

and the bladder and rectum being pressed over to the right side the pelvic fascia may be examined. Separating the peritoneum from the pelvic fascia, and carefully clearing away any fat, he will see that the latter is attached to the inner surface of the symphysis pubis and to the ileo-pectineal line of the brim of the pelvis as far back as the sacro-iliac articulation, and that it extends downwards on the walls of the pelvis to the lower border of the symphysis in front and the spine of the ischium behind, where it forms a white band and subdivides into two layers, an external or parietal and an internal or visceral. This latter, commonly known as the recto-vesical fascia, is the one of most interest to the lithotomist; it is reflected on the upper surface of the prostate, and from the gland backwards upon the neck and sides of the bladder and forwards to the symphysis pubis. At the symphysis it is continuous with the fascia of the opposite side, and blends with the posterior layer of the triangular ligament, so as to close in the front part of the outlet of the pelvis. A prolongation of this fascia passes downwards to the under surface of the prostate, forming the lower portion of its capsule, and is stretched across the pelvis from one side to the other as a horizontal septum between the upper and lower part of the pelvis, with the prostate

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and bladder lying upon it above and with the rectum below, while posteriorly it has an attachment to the recto-vesical pouch of the peritoneum.

Levator ani.

The levator ani muscle should now be examined by clearing away the recto-vesical fascia covering its upper surface, beginning at the base of the bladder and continuing the dissection until the whole extent of the muscle is exposed. It will be seen to arise from the white band on each side of the pelvis (formed by the subdivision of the pelvic fascia) and from the adjoining bones, and then to pass inwards, joining its fellow of the opposite side. The most anterior fibres support the prostate as it were in a sling; others are inserted into the walls of the rectum, and the posterior fibres blend with those opposite, and are attached to the sides of the extremity of the coccyx. It thus forms a muscular floor to the outlet of the pelvis, just as the deep perineal fascia forms a membranous one.

Internal pudic artery.

The last point to be observed is the internal pudic artery. On removing the obturator fascia it will be seen to rest on the internal surface of the tuberosity and ramus of the ischium at about an inch and a half from the margin of the former, inclining inwards until, in the interval between the two layers of the triangular ligament, it comes to lie close to the margin of the latter.

Besides the above-mentioned parts, which I

think an operator ought to dissect before performing lithotomy, there are certain other points of anatomy which it is very necessary to well understand.

Certain other points of anatomy.

The axis of the bladder lies on a plane lower, but nearly parallel to that of the axis of the superior aperture of the pelvis, which is marked by a line from the vicinity of the umbilicus downwards to the os coccygis.

Axis of the bladder.

Still more important, however, is it to know the axis of the inferior aperture of the pelvis, and therefore the direction in which extraction of a calculus from the bladder should be made; this corresponds with a line drawn from the upper part of the sacrum to the centre of the outlet, between the tuberosities of the ischia.

Axis of inferior outlet of pelvis.

The shape of the outlet of the pelvis is well described by Sir H. Thompson as that of an inverted heart, with the apex upwards at the lower border of the symphysis pubis. The measurements in a well-developed adult are given by him as follows:—"From apex under pubic symphysis to the os coccygis, about $3\frac{3}{4}$ to 4 inches. From the anterior part of one tuber ischii to the corresponding part of the opposite bone, about 3 inches. From the apex to each tuber ischii at the part just named, about 3 inches. Consequently, the two last measurements include a right-angled triangle, the peri-

Male pelvis.

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neal triangle of the anatomist." The greatest extent of incision which can be made in lateral lithotomy is about $4\frac{1}{2}$ inches, this being the usual distance between the under part of the symphysis pubis and the sacro-sciatic ligament. Mr Coulson says that, transversely on a level with the posterior edge of the prostate, the distance from the ramus of one os pubis to that of the opposite is about $1\frac{3}{4}$ inch; but diminished of course when all the soft parts are *in situ*. Sir H. Thompson remarks that in some bodies the pelvic outlet is narrower than the above measurements, and that if the lateral operation is performed in such cases, the line of the incisions must be less oblique than usual. He also says that a fact to be remembered in the extraction of large stones is, that the above-mentioned space is yielding behind, but is enclosed by bony walls above and at the sides.

Distance of certain
parts above the anus.

The distance of the bulb and other parts above the anus and in front of the rectum is stated by Mr Butcher to be as follows:— "The bulb is about an inch above the anus, and half an inch in front of the rectum; the membranous portion about an inch and a half from the anus, and half an inch in front of the rectum; the prostate gland from two to two inches and a half above the anus, lying on the anterior wall of the bowel, and separated from it only by a line's breadth of dense cellular tissue."

CHAPTER III

SUBJECTIVE SYMPTOMS OF CALCULUS IN THE BLADDER.

PATHOLOGICAL EFFECTS

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THE subjective symptoms of calculus, namely, those resulting from the patient's own sensations, cannot be relied upon without the aid of the physical signs derived through the use of the sound. The symptoms depend on the calculus acting as a foreign body in the bladder, and are liable to remissions and exacerbations, the latter attended with great suffering and termed "fits of stone;" these appear to be brought on by over-exertion, indigestible food, or constitutional derangement, causing spasm of the muscular coat of the bladder.

Pain is generally at first intermittent, but after ^{Pain.} a time becomes constant in the bladder, being referred especially to the neck of the organ during and after micturition. It is particularly felt with the last few drops of the urine, and produces such irritation at the end of the penis that children endeavour to relieve it by constantly squeezing and pulling forward the extremity of the penis with the prepuce, thereby causing an elongated condition of the latter. The pain in this situation

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is a sympathetic one, coming from the neck of the bladder on account of the calculus during micturition rolling forward and being grasped by that most sensitive part; and this shifting of the stone also produces a characteristic action on the part of the patient, leading him instinctively to lean forward on his elbow and knees, or even on the top of his head, during the emptying of the bladder in order to cause the stone to fall away from the neck of the organ. The pain is aggravated by all kinds of exertion which cause jolting of the body, such as walking, riding, or jumping, and it usually increases with the duration of the disease. Besides the one above mentioned, other sympathetic pains are frequently reflected from the bladder to the peripheral extremities of the sacro-lumbar nerves distributed to the kidneys, perineum, rectum, groins, outside and back of the thighs, and soles of the feet, or, in the last, a burning sensation only may be felt. Other occasional sympathetic effects are a morbid sensation of contraction of the scrotum and swelling of the testicles. The amount of pain varies much in different patients: it depends especially on the nature of the calculus with its degree of smoothness or roughness, and upon the attendant constitutional state.

In exceptional cases the calculus has been attended with a mere feeling of weight in the

hypogastrium or perineum. In other and equally rare cases the pain after troubling the patient for a long period has ceased entirely; or the disease has existed for a considerable time without pain, until suddenly after exertion it has attacked the patient.

Varieties in the symptoms, such as the two last mentioned, usually depend on the presence of sacculi in the bladder, as explained in the chapter on encysted calculus.

In paralysis of the bladder the presence of calculus causes no pain.

Micturition is frequent on account of the foreign body causing irritability of the neck of the bladder, the impulse to pass urine often being irresistible and induced by the slightest change of position. Another striking symptom is that during the act of micturition the calculus is liable to fall over the vesical neck, leading to one or more momentary stoppages of the stream of urine during its flow.

Sir H. Thompson writes on this symptom as follows:—"The patient has for some time had more or less frequency, but it is increased during the day when moving about, and decreased at night, when he is at rest. This is contrary to what usually takes place in prostatic enlargement, and hence it is a good diagnostic point."

In a large proportion of cases the urine will

Urine.

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throw down a deposit on standing, and on the application of heat will become more or less milky from the presence of albumen.

Blood.

Nearly every patient with calculus sooner or later observes blood mixed in his urine, most commonly after exertion: slight hæmaturia is often one of the earliest signs of the disease, and should, especially in children, lead the surgeon to make an examination with the sound without delay.

Tenesmus.

Troublesome tenesmus is a frequent symptom. In children, especially, the rectum is apt to be prolapsed, and the fæces to be passed with every act of micturition.

Modification of symptoms in encysted calculus.

When the calculus is encysted all the above symptoms are modified; there are seldom the temporary stoppages of the flow of urine during micturition, the hæmaturia, and the same increase of pain from jolting movements of the body as exist when the stone is loose in the cavity of the bladder.

Symptoms progressive.

The patient, if unrelieved, becomes very much shattered in health in the course of two or three years, or earlier: alkalescence of the urine takes place, the triple phosphate being then deposited on the original calculus, and the sufferings then become very great, especially in patients with fusible calculus whose nervous system is always morbidly sensitive. Serious inflammation of the

mucous lining of the bladder now occurs, evidenced by great pain and an almost constant desire to void the urine, which is offensive to the smell, deposits much muco-purulent matter streaked with blood, and, on standing, soon becomes ammoniacal and putrid, and the patient is at last worn out by hectic, either with or without the supervention of extensive disease of the kidneys.

In the lithic-acid diathesis in children, all the subjective symptoms of calculus may occur in a marked degree without there being one. Also other disordered conditions may produce somewhat similar symptoms, some of which are—irritation of the rectum by ascarides, irritation of the kidney by lodgment of a concretion in its pelvis, phymosis, disease of the prostate and irritability of the bladder. With respect to the last two, however, there is a very striking difference in the symptom of pain, for in them relief is experienced after micturition, while in calculus the suffering is much increased.

Mr Bryant gives most useful advice upon the diagnosis of the presence of calculus; he says that the surgeon should have his suspicions excited in such a case as the following:—"The child had been observed to play with the penis after micturition; the stream had occasionally been interrupted in its flow, and . . . a frequent call to make water

Symptoms deceptive.

Importance of early detection of calculus.

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had long existed, with a disposition to drag at the penis." He also considers that both retention and incontinence of urine should excite suspicions, and that in all cases of persistently irritable bladder it is the safest plan to sound, as the early detection of stone is very important, the patient then being less likely to be affected with renal mischief, and consequently a better subject for operation than he would be later in the disease.

Pathological effects.

One of the first effects of the presence of a foreign body in the bladder is chronic inflammation of the mucous membrane as indicated by frequent micturition, pain, and increased secretion of mucus; and from this constant vesical irritation the other coats of the bladder become diseased, and concentric hypertrophy with diminished capacity of the organ takes place. A serious state of disease of the lining membrane ensues; it may either become greatly inflamed or ulcerated, the ulcers being frequently observed at the neck and bas-fond of the organ. Sooner or later the kidneys and ureters are affected, and in the worst forms of the disease one of the former may be converted into a large pouch filled with purulent matter and one of the latter into a fibrous cord, the patient being finally worn out by hectic. Gross says, "The period at which death occurs ranges from eighteen months to ten, fifteen, twenty, or even thirty years."

CHAPTER IV

SOUNDING AND PASSING THE STAFF

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Sounding.

THE proper and careful performance of sounding is of much consequence, as the sound emitted by a calculus on being struck with a metallic instrument is the only sure sign of the presence of stone in the bladder. This sound is dull in the soft calculus; but gives a metallic ring in the hard.

Sounding, like nearly every operation, small as well as great, may give rise to serious injury if not performed carefully. It is said that a hole may be made in the bladder with the point of the sound if the surgeon rub it forcibly against the bony walls of the pelvis in his over-anxiety to detect a stone.

The instrument should be passed carefully, like a bougie or catheter, and made to glide along the upper surface of the urethra by its own weight rather than by the use of any force on the surgeon's part. It should not be so large as to be closely embraced by the urethra, as such a sound

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would require some force to push it forward, and when in the bladder its free motion there would be prevented.

Before sounding children it is often necessary to administer chloroform.

Morbid sensibility of
urethra, &c.

When there is great morbid sensibility of the urethra and neck of the bladder (a state which is liable to result from the fatigue incident to a long journey or from stricture) sounding is apt to excite serious sympathetic disturbance, and then it must be conducted with great caution or deferred until the parts can be brought into a more healthy condition. Gouley, of New York, writes —“ Very grave consequences often ensue from the too precipitate use of instruments, especially in persons who have not quite recovered from the fatigue and depression incident to a long journey.

. . . . The patient should be allowed a few days' rest in the horizontal posture, with a pillow under his hips in order that the stone may roll back to the less sensitive part of the bladder. .

. . . He should be directed to urinate only while lying down, that the calculus may not be forced against the vesical neck. This may be difficult at first, but in a few days he will experience no trouble in emptying his bladder by turning on either side or even upon his back.” To this advice I would add that after the sounding is accomplished the patient should not be allowed

to leave for his own home until any irritation set up by it has subsided.

In ordinary cases, on account of this liability to irritation, I avoid repeated sounding, deferring the use of the sound until the patient is prepared for operation, which is then proceeded with or relinquished according to the information obtained.

Besides being done carefully, sounding should always be performed in a systematic manner in either the first or second position described below, the bladder containing three or four ounces of fluid.

The patient must be placed on his back, his First position. thighs being separated and a little flexed, and his pelvis slightly above the level of the shoulders, the latter being on the same plane as the trunk with the head raised on a pillow. The advantage of this position is that the calculus will generally be found a little behind the vesical neck.

Sir H. Thompson says—"If we do not succeed Second position. in that position" (the first), "or if his prostate is enlarged, he should be placed in the second position; in this the pelvis is raised from four to six inches above the level of the shoulders; a firm cushion of sufficient thickness is placed beneath the pelvis, so as to support the sacrum and tubera ischii. The thighs are slightly raised ;

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they must not incline from the pubes downwards, or the position of the pelvis will be interfered with. The abdomen, on the contrary, inclines backwards from the pubic symphysis. The stone now lies towards the posterior wall of the bladder, at a little distance from its neck, varying in proportion to the elevation of the pelvis. This position is generally desirable when there is an enlarged prostate. It is so often when the patient is very stout, and the abdomen protuberant." This is also the best position when searching for a small stone.

Situation of calculi in bladder.

A large stone will generally be found lying close to the neck of the bladder. A small or medium sized one is often situated on the floor of the organ behind the trigone on one or other side of the mesial line.

Difficulty in introduction of sound.

Difficulty in the introduction of the sound may occasionally occur from the diseased states to which the urethra, prostate, and neck of the bladder are liable on account of the presence of calculus in the bladder: some of which are spasm of the urethra or of the neck of the bladder; relaxed mucous membrane and enlarged glandular openings of the urethra; and irregularities of the prostatic portion of the urethra from the presence of stone in the gland. The best way of overcoming these obstacles is similar to that which is recommended when difficulty

is met with in passing the staff, as described further on.

The sound having been passed into the bladder, the calculus is sometimes immediately found, and with a gentle striking movement the characteristic click is elicited, but if not, the surgeon, passing over to the right side of the patient, revolves the handle of the sound gently between his fingers and thumb, thus moving the point of the instrument from side to side, and next rotates it downwards on each side towards the depression behind the prostate, directing the end of the instrument to that part by raising the handle well towards the abdomen of the patient. The remaining parts of the cavity must then be explored by the same side-to-side combined with backward-and-forward movements. The surgeon will also be assisted by raising the bladder up with the finger in the rectum, or by depressing it with the hand upon the hypogastrium, or it may be useful to turn the patient slightly to one side or the other, as the position of the stone in the bladder will thus be changed.

If the operator fail with the ordinary sound, he will find Thompson's a good one; it has a beak a little more than an inch long, which enables the surgeon easily to incline it to the right or left in the bladder, or completely to rotate it if need be. It is especially useful in searching for small

Special form of
sound.

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stones and for employment in elderly patients, in whom the calculus is often found in a pouch behind the prostate, requiring for its detection that the beak of the sound should be turned completely downwards. .

Difficulty in detecting calculus.

Sometimes the calculus can be detected at one time and not at another, from being caught up temporarily by the folds of the bladder or from becoming engaged in pouch-like irregularities in the coats of the bladder when in a state of disease; in such cases the surgeon should be cautious before proceeding to operate, as somewhat similar symptoms arise when the stone is permanently encysted.

A small stone may elude the sound merely from the bladder being too full of liquid, and then evacuation of the water or sounding in the erect position may cause it to be felt.

Remarkable difficulty is occasionally met with in finding the calculus, though the general and local symptoms may be so strongly indicative of it as to leave no reasonable doubt of the presence of one. Butcher says in one case he sounded the child five times before he succeeded in detecting it. In these cases no prolonged exploration at one time (seldom exceeding five minutes) should be made in search of the calculus, lest the mucous membrane of the bladder be inflamed; but it is better when not

readily found that the examination should be deferred to another occasion. On again sounding the patient, it should be done with the bladder filled with four or six ounces of tepid water, so as slightly to distend the mucous membrane and prevent its overlapping any little stone which may be present. If still unsuccessful, the patient should stand up, and the contents of the bladder being allowed gradually to escape, the sounding should be again proceeded with, when the calculus may be discovered either during or after evacuation of the fluid. In order to carry out this plan efficiently the surgeon should be provided with a hollow steel sound with a stop-cock, like the one recommended by Mr Erichsen; but in the absence of this the urine must be permitted to escape by the side of the sound, and as the bladder contracts, the calculus may be felt.

Before giving up the attempt to find the calculus, the surgeon should examine the portion of the bladder above the symphysis pubis, and to do this readily he must tilt up the beak of the sound well by depressing its handle between the thighs of the patient. He should examine the patient in the erect position, as well as resting on his hands and knees. He should also slowly inject into the bladder as much warm water as it can contain, for if the calculus is fixed behind the

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pubes this will loosen and bring it down to the vesical floor.

Error in sounding.

Error in sounding is very possible if the surgeon is hasty and inexperienced; thus, the hard rugose state of the muscular fibres of the bladder, when hypertrophied, may lead him to think that he has struck a calculus, though the way the beak of the instrument grates over the part is very different from the metallic ring of a stone; in children especially, he may be similarly deceived by the sensations derived from quickly passing the sound over the projecting rugæ of the bladder, when rugose and perhaps encrusted with sabulous matter.

In any patient, but also especially in children, he may be misled into thinking a calculus is present, from striking the sound against the promontory of the sacrum, spine of the ischium, or brim of the pelvis. In all these conditions a rough grating or a dull heavy sensation is conveyed to the *hand*, and sometimes, though not always, to the ear of the surgeon, but never the metallic click of a calculus; if he were always to hear this, and also not be satisfied unless he could isolate and move the calculus about in the vesical cavity, he would avoid mistake. These latter precautions will also prevent his mistaking for an ordinary calculus a sacculated or encysted stone, calcareous matter adhering to the

walls of the bladder, tumours at the neck of the bladder, or an enlarged third lobe of the prostate encrusted with sabulous matter; the most deceptive of these is the last, from being pendulous, and so allowing the sound to pass above and under it.

Thompson brings to notice the interesting fact, mentioned in the following quotation, that it is quite within the range of possibility for a surgeon, after a superficial examination with the sound only, to diagnose the case wrongly, though the bladder may be filled with a large calculus:—
“There is a practical point of importance to be noticed in connection with very large stones. It is the very slight evidence that can be obtained by sounding in certain cases. . . . A sensation indicating the presence of a mortar-like mass was felt on the instrument passing through the neck of the bladder, and after that nothing.” This mistake could not, I think, well occur if the finger were employed in the rectum to assist in the diagnosis.

Lastly, he may be led to a wrong conclusion by the existence of stones in the prostate. As long ago as 1820 Charles Bell wrote that it is very important to recollect these “in sounding for stone, for the points of the small calculi sometimes project from the ducts of the gland so as to give the sensation, when the sound is entering

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the bladder, as if it struck upon a stone. It will generally be found that on the first introduction of the instrument the *rub* is felt; but on withdrawing the sound and introducing it again, the stone is not again felt. This is probably in consequence of the projecting point being pushed, by the first introduction of the instrument, back into the little sac it occupies in the prostate."

Diagnosis of multiple calculi.

Sir H. Thompson writes—"It is exceedingly difficult, if not impossible, to determine this accurately with the simple sound, the signs afforded to it by multiple calculi being very deceptive. With the lithotrite it is easily determined. One calculus being seized, it is held between the blades, and the search is continued for a few moments with the stone in that position. If another is present it is almost instantly struck." In this manner, he says, a calculus may be struck by each side of the instrument, which would show the existence of at least three stones. In the absence of a lithotrite the sound must suffice, and will sometimes discover the presence of multiple calculi by giving the sensation of striking one stone after another, and by eliciting from the different calculi sounds distinct from each other.

Classification of calculi according to texture.

The classification of calculi according to texture is into *soft* and *hard*, with a subdivision of the latter into *friable* and *compact*.

The relative frequency of the different kinds of calculus according to their chemical nature is thus given by Sir H. Thompson :—"Uric acid and the urates form about three fifths in number, the rest being phosphates, with the exception of about 3 or 4 per cent. of oxalic-of-lime calculus," and "very rarely a calculus may be formed of pure phosphate of lime or of cystine."

The soft calculi are phosphatic and generally large. The hard are the oxalate of lime, uric acid, urate of soda, and mixed ones, these last having alternating layers of either uric acid or urate of soda with phosphatic deposit. The determination of the texture is founded on the characters of the urine, as explained in Chapter V, and on the sound emitted on sounding, the hard giving a clear and sonorous ring, the soft a dull one.

Coulson has classified calculi according to size, Classification according to size. as follows :—"Generally speaking, a lithotomist would call a stone below nine or ten lines in diameter a small one; from ten to fifteen lines a moderate one; from fifteen to twenty lines and above a large calculus." For the clear understanding of the above, it must be explained that the diameter of a stone must be looked upon as the mean of two diameters, the longest and the shortest.

The relative frequency of calculi of different

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Relative frequency of
calculi of different
weights.

weights is stated by Mr Coulson to be as follows : —“75 per cent. of the calculi were under one ounce in weight ; 17 per cent. under 2 ounces ; 5 per cent. under three ounces ; the proportion of those above three ounces was about $1\frac{1}{2}$ per cent. ; the remainder a little less than $\frac{1}{4}$ th per cent.”

The late Mr Crosse estimated the frequency of calculi above three ounces as greater than the above ; according to him stones varying from three to six ounces are met with about once in thirty-five cases.

Diagnosis of size of
calculus.

The size of the calculus can be best determined by a light lithotrite, though even with this the surgeon may be deceived, as he may seize the stone again and again in the same diameter. It is very necessary that every lithotomist should be provided with such an instrument, for with the sound only he cannot judge with any accuracy of the size of the stone. The importance of this knowledge to the operator Coulson has particularly insisted on, for without it, he says—“The extent of his internal incision, and the degree of force he is to employ during extraction—that is to say, the two most important points of his operation—must be guided by an element which is imperfectly known to him.” The sound, as already stated, is not a certain guide to the size of the calculus, unaided by the lithotrite ; for the operator with the former only may even mistake a small for a

large calculus, or two or three small stones for a large one; though in addition to or in the absence of the lithotrite, valuable information may be derived from its careful use. If the sound strike upon the calculus immediately on entering the bladder, and the surgeon cannot push the stone out of the situation in which it lies without the use of much force, and especially if this is the case after the bladder has been injected with water, it is probably a very large one. Additional confirmation of the size of the calculus, with some idea of its exact length and breadth, may be derived from examination with the finger per rectum, or it may be possible to catch the stone between two fingers inserted in the rectum, pressure being made at the same time upon the hypogastrium, and thus to form a still clearer idea of its dimensions. In most cases a fair judgment of the size may be arrived at by passing the point of the sound to the far end of the calculus, and then drawing it forwards along the surface of the stone with a slow and slight rotatory motion, observing how much of the handle of the sound emerges from the urethra during this process, as this will be equal to the length of the calculus. The lateral diameter can be ascertained by carrying the convex side of the sound from one side to the other of the stone, and noticing the space which the handle of the instrument traverses while doing this.

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Condition of the bladder to be ascertained.

Besides the examination of the calculus, the sound may be also usefully employed for ascertaining the capacity of the bladder, with the state of its walls, and particularly for detecting their columnar condition, should such exist.

Introduction of the staff.

The staff, which on account of its groove has a less smooth and rounded point than the sound, is more liable than the latter to be obstructed by irregularities of the urethral canal during its introduction, and more so in children than in adults.

Difficulty from obstructions in urethra.

Difficulty in introducing the staff may occur from passing its point along the lower surface of the urethra, by which it is apt to catch in one of the openings of Cowper's or other glands; in the lower part of the triangular ligament below the symphysis pubis, or in the walls of the urethra beyond the pubic arch, the last-named accident being especially liable to happen in the child when the point of the staff is kept low, instead of being in constant gentle contact with the upper surface of the urethra, which in the young takes a sharp curve upwards beyond the arch. It occasionally catches in relaxed mucous membrane of the lower surface of the urethra at the apex of the prostate; also at the neck of the bladder, when the entrance into it is deformed and obstructed by a stone being lodged there. To overcome these obstructions the surgeon should draw back the point of

the staff gently and then try to pass it on again, directing it along the upper wall of the urethra, but in doing this he must employ no force, as a false passage is easily made, more particularly in the young. He will, perhaps, be able to accomplish its introduction with the patient standing, if he should fail to do so in the recumbent position.

In some instances it is hindered by spasm of the urethra (especially of the membranous portion), or of the neck of the bladder, and then, if the instrument is kept gently pressed against the obstructed part for a few minutes, the spasm may yield, or, if not, the administration of chloroform may be successful. Difficulty from spasm

In addition to the above-mentioned measures, one which is found to be successful when the point of the staff constantly catches in some obstruction is to pass the instrument immediately after micturition, and it has often happened that a larger staff has ridden over an obstacle that has repeatedly intercepted a smaller one. In connection with this suggestion a slight caution is needed, namely, that in employing a full-sized staff the surgeon should not select one which is *tight* in the urethra, as such cannot be introduced with that gentleness which is the only safeguard against making a false passage.

If after a trial, which it is seldom wise to

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Trial not to be prolonged.

prolong over five minutes, and which should on no account exceed ten, no staff can be introduced, the operation must be deferred to another day, lest longer fruitless efforts should cause impatience and lead to force being used, with the probable formation of a false passage. The same difficulty may not be met with on the next occasion, for, should the obstruction have resulted from a bit of stone in the prostate, causing irregularity of the prostatic portion of the urethra, or from such a position of the vesical stone as to close or obstruct the entrance into the neck of the bladder, the situation of the stone may have changed in the interim.

CHAPTER V

EXAMINATION OF URINARY ORGANS, AND GENERAL
HEALTH OF PATIENT, WITH REGARD TO HIS FITNESS
FOR THE OPERATION OR OTHERWISE. ALSO MODE OF
DETERMINING NATURE AND SIZE OF CALCULUS

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Selection of cases.

THE examination of the state of the kidneys and of all the organs of the body should be carefully made before subjecting a patient to the operation of lithotomy; for, as Mr Erichsen says, "when the patient is greatly emaciated, his constitution broken down, and his kidneys evidently disorganized extensively, lithotomy would be attended by an inevitably and rapidly fatal result, and the performance of an operation would be an useless act of cruelty."

The rule for the rejection of cases expressed in the following quotation (from what source I forget) is one which is probably as good as any:—"An operation is justifiable only when the chances of life and death are about equal. . . . If in a given case . . . death was the most probable result . . . it would be the duty of the medical attendant to decline to

Rule for rejection of cases.

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directly hasten the death of a patient who was already doomed."

Sir B. Brodie's views
on selection of cases.

Sir B. Brodie has advanced very cogent reasons for not subjecting all cases indiscriminately to the operation of lithotomy ; such a practice, he writes, "only tends to bring it into disrepute, and prevent some other persons submitting to it, in whom there might be scarcely a doubt as to its success."

Rejected cases may
live for years.

In support of the practice of the rejection of a case when the chances of success from an operation are a minimum, it must be remembered that the patient is not necessarily condemned to early death or even to great suffering, for it has been observed in many patients with large calculus and the subjects of organic disease that by care they have lived for years without much suffering, and have eventually died of an ailment with which the stone was unconnected. There need be little hesitation in declining to operate if such a patient be an old man in whom the presence of the calculus causes little or no inconvenience, and if its enlargement be very slow.

Cases not to be hastily
rejected.

On the other hand, the surgeon should not hastily refuse to operate on any patient, more particularly in the case of the young, in whom the operation is so successful a one that, however weakly and diseased, they may nearly always be operated upon with a good chance of success. The most unfavorable states in these would be

uræmia; such exhaustion or other condition as is indicative of approaching dissolution, or the calculus so large as to form a complete cast of the bladder—all which would render the patient unfit for any operation. South gives the following reasons for careful consideration of every case, however unpromising at first sight:—"Experience shows that even under the most unfavorable circumstances the operation is successful, and that with the removal of the stone, the symptoms depending on its presence, as for example, the chronic inflammatory affection of the bladder, cease."

The late Mr Syme made a remarkable statement (not, however, I think, borne out by the statistics of other authorities), namely, that he always observed the risk to be comparatively slight, "when the patient is reduced by continued and incessant pain, provided no organic disease has been excited in any part of the system."

While some organic diseases are evidenced by such plain symptoms that there can be no doubt about the unsuitability of the case for operative treatment, yet others (and these very common and fatal forms of organic lesions of the kidney), namely, chronic nephritis and granular degeneration, are sometimes attended with such ill-marked symptoms as cannot be certainly distinguished from those which belong to the accompanying

Chronic organic disease of kidneys.

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vesical disease. The surgeon is then left in doubt about the extent of the disease, and it will under these circumstances often be his duty to give the patient the chance of a successful result from the removal of the stone, without having made a certain diagnosis of the extent of the disease in the kidneys.

Chronic nephritis,
pyelitis, &c.

Chronic nephritis, pyelitis and degeneration of the kidneys cannot always be discovered by urine analysis, though the two latter, Erichsen says, are "chiefly evidenced by the presence of albumen in considerable quantities in the urine and granular casts with muco-pus." Urine, however, containing much albumen in any patient (in children even to the extent of one third or even half its bulk) does not necessarily contra-indicate an operation if *all other circumstances are favorable*. In the absence of a marked albuminous condition of the urine, a suspicion more or less strong of the existence of one or other of these diseases may be inferred from certain signs, the least equivocal of which is one that not unfrequently occurs, namely, a purulent condition of the urine, sometimes to such an extent that a great abundance of pus is found on analysis: if with this be conjoined a low febrile state of the system with a continued high temperature; a sense of discomfort or actual pain in the loins; sympathetic irritation of the stomach and testicles, and diseased kidney epithelium in the

urine, the presence of pyelitis is probable. If the pus should result from suppuration and abscess of the kidneys the symptoms will be less doubtful: Dr Prout writes, that when "nephritis ends in suppuration and abscess, the circumstance is usually indicated by rigors followed by febrile exacerbations and sweatings—in short, by all the symptoms of hectic. The urine, at the same time, becomes loaded with pus, or purulent-looking mucus."

With reference to Bright's disease, Sir H. Bright's disease. Thompson writes:—"When the disease is in an advanced stage, no condition is more unpromising for the success of an operative procedure." Fortunately, however, according to this author, "it is not common to find calculus associated with those systemic changes which manifest themselves in the production of either fatty deposit" or "Bright's disease, and the existence of which is evidenced by persistent albuminuria, renal casts in the urine, and, in advanced stages, by dropsical effusions in the cellular tissue, and in derangements of the cerebral functions."

Acute inflammation of the kidney, bladder, or Acute diseases. any other organ is a distinct contra-indication to the performance of an operation, at any rate until the inflammation has been subdued.

In many cases of acute nephritis, in which the Acute nephritis. specific gravity of the urine is 1020 or higher, .

diminished in quantity, and in colour of a dark brown or smoky hue (caused by the action of the acid of the urine on the colouring matter of the blood) or reddish from the admixture of blood, albumen also being present in considerable quantities, there can, judging from these and all the other symptoms of the case, be no doubt of the nature of the disease. Sometimes, however, the symptoms are less marked on account of the modification the inflammatory action undergoes in a degenerated kidney; a diminution in the secretion of urine, which in the latter stage becomes very scanty indeed, being the most pathognomonic one, and anasarca is occasionally one of the first symptoms that attract notice, and is always a very conclusive one. Dr Prout writes:—“In inflammatory attacks of almost every form of diseased kidney, one of the first observed symptoms, as far as the urine is concerned, is a *diminution in its quantity*; accompanied, of course, by a corresponding deepening of its colour, and an increase in its specific gravity. These changes are usually most remarkable in inflammation of the hæmotrophied kidney,” a state connected with an increase of sanguineous nourishment. “Analogous phenomena, though of a much less marked kind, are usually presented by the urine in the anæmotrophied conditions of the kidney.” This latter is a

state of degeneration connected with a deficiency of sanguineous nourishment; in this condition the urine is neutral or alkalescent, but occasionally becomes acid during inflammatory attacks, and the inflammation is ushered in by rigor, followed by fever, not however of so marked a character as in the more sthenic attacks. If, together with these symptoms, those more especially resulting from kidney irritation should be conjoined, such as pain with or without pressure over the kidneys, and various forms of gastric derangement, particularly vomiting and hiccough, the diagnosis will be strengthened.

This inflammation extends up the ureters to the kidneys, and places the patient in a dangerous and almost desperate situation; indeed it rarely sets in except as one of the last stages of the calculous disease. Sir H. Thompson has described the symptoms as follows:—"The inclination to void the urine is then incessant night and day, preventing sleep, and attended with horrible suffering. The urine deposits a large quantity of offensive, ropy, adhesive mucus, of a red colour, in consequence of blood being blended with it." Even if this inflammation should subside and an operation be performed, there is an unfavorable circumstance connected with these cases, namely, that the inflammation may have extended to the loose cellular membrane by which

Acute inflammation
of the bladder.

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the bladder is surrounded, and have left an abscess in that situation. After these attacks also, the pelvis, with the infundibula of the kidney, has been found to contain pus.

Acute inflammation of prostate.

Acute inflammation of the prostate in advanced life, and when the gland is enlarged, generally arises from the irritation of the introduction of instruments into the bladder. The symptoms cannot well be mistaken: fever will be present; a continued throbbing pain about the perineum, increased by sitting, evacuation of the bowels or by examinations; micturition will be frequent, difficult and very painful, and sometimes there will be complete retention of urine.

Typhoid states.

All typhoid conditions, upon whatever cause depending, would, of course, temporarily prevent an operation.

Continued high temperature.

A continued high temperature of the body would generally be a sufficient reason for declining to operate until the fever had subsided.

Catarrh or chronic inflammation of bladder.

Some amount of catarrh of the bladder or chronic cystitis is an almost necessary consequence of the presence of a calculus in the bladder, and, so long as the inflammation does not become acute, is not a contra-indication to the operation, but is rather a reason for early recourse to it, as the only cure for either state is the removal of the concretion.

Coulson says ulceration of the mucous coat

seldom ensues except in old cases and in the last stage of the disease. Under such circumstances an operation would probably quickly prove fatal. The symptoms which would indicate an advanced stage of ulcerated bladder would be, a hectic form of fever with much prostration of the strength of the patient; the urine purulent and perhaps mixed with blood, or deep coloured, serous and alkalescent like the washings of flesh, and with a strong ammoniacal odour. If the blood mixed with the urine is of a very dark colour, and if other unnatural matters are also found in this secretion, having a very offensive and putrid odour, the ulceration is probably of a malignant character.

This, like ulcerated bladder, according to Coul- Ulcerated prostate.
son, seldom takes place until towards the termination of the disease, and he says "it exercises a most unfavorable influence on any operation to which we may have recourse." That portion of an inflamed prostate which extends backwards into the cavity of the bladder is the part which becomes the seat of the ulceration, and consequently the sufferings of the patient are dreadful. In a case described by Sir B. Brodie, there was great discomfort felt as soon as a few ounces only of urine were collected in the bladder, so that it was necessary to introduce the catheter several times in the twenty-four hours; and there was

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also hæmaturia. "These symptoms," he says, "gradually increased, until at last the accumulation of even two or three ounces of urine produced violent spasms of the bladder and abdominal muscles, attended with such agonising pain that he could not forbear screaming." He mentions two patients with ulcerated prostate, who were operated upon, one of whom died in a few minutes, and the other within a few hours; and he gives it as his opinion that, if the nature of such a case can be previously recognised, no operation ought to be performed.

Abscess of the prostate.

Coulson writes that, in patients labouring under calculus vesicæ, "abscess of the prostate is not very uncommon; it may occupy the substance of the gland, or commence in the excreting ducts. . . . The abscess itself may open into the ureter, the bladder, the rectum, or the perineum." Solly mentions a case in which lithotomy, performed notwithstanding this complication, proved remarkably successful, for by it not only was the calculus removed, but the abscess was likewise freely laid open, so as to allow a healing process to take place.

Paralysis of the bladder.

True paralysis of the bladder, which generally denotes some serious lesion of the spinal cord, would, I think, render the advisability of an operation very doubtful. This, however, is not commonly met with in calculous patients, a more

usual form being that well described by Mr Coulson, and called by him calculous atony of the bladder, the muscular fibres in which are weakened rather than actually paralysed. Though a slight degree of this paralysis would not contraindicate lithotomy, yet when the bladder is completely paralysed, the powers of feeling and of contraction being altogether lost, I think the advisability of an operation would in many cases be doubtful, especially as this condition is one in which the presence of the calculus in the bladder does not cause suffering.

Lithotomy is not justifiable when diabetes Diabetes. is present, this disease rendering the patient liable to extra-vesical cellulitis and other low and diffuse forms of inflammation after the operation.

Deformities of the pelvis and of its outlet, Deformities of the pelvis, &c. disease of the hip-joint and tumours of the perineum may render the case unsuitable for the lateral operation (though not perhaps for another method) by making it impossible to penetrate the membranous portion of the urethra.

Excessive size of the calculus, that is, any over Excessive size of the calculus. six ounces in weight, will be certainly unfit for the *lateral* operation, and when much larger, it is very unlikely that any form of operation will be attended with success.

Diseases of other organs, except malignant

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Diseases of other
organs.

forms of disease, or severe organic disease, do not necessarily, provided the urinary organs are in a fairly healthy state, contra-indicate lithotomy. When affected with any of the following, especially in their advanced stages, namely,—phthisis, disease of the liver or spleen, peritonitis, valvular disease of the heart or fatty degeneration of its muscular fibres, the patient will seldom be a fit subject for operation. Of the above mentioned, the last is the complication most commonly met with in calculous patients, particularly in old ones: a marked symptom caused by it is,—such extreme weakness of the sounds of the heart as to render the first one inaudible, and the second very feeble at the aortic orifice.

Albumen.

General observations.

When examining a patient as to his fitness or otherwise for undergoing the operation of lithotomy, the first and most important point to determine is the amount of albumen, for if this be one sixth or more of the bulk of the urine it will generally indicate serious disease of the kidneys in the adult, making any operation about the urinary organs dangerous on account of the liability which exists in such cases to the super-vention of inflammatory action in the already diseased kidneys, and also to low and diffuse erysipelatous affections of the pelvic cellular tissue. Though, considered alone, albumen to this extent depending on diseased kidneys is the

most important of all reasons for rejecting an adult case, yet, if all other circumstances are favorable, such as the general health, the size of the calculus, amount of solids excreted, and state of the bladder, as indicated by the absence of an ammoniacal condition of or the admixture of much mucus and pus in the urine, the patient may be given the chance of operative relief with a fair prospect of success.

As before stated, albumen to a much greater extent than this in children will not ordinarily be a sufficient reason for declining to operate.

The lithotomist must bear in remembrance that there are other sources from which albumen may be present in the urine besides the serum of the blood, which, escaping from a diseased kidney, has mixed with the urine: it may be derived from blood itself, or from certain conditions of increased prostatic secretion, and in neither case does it always indicate a very serious condition of disease.

On the other hand, a serious error will be committed if the kidneys are always inferred to be healthy, because the urine contains little or no albumen. In several instances I have found this to be the case when the kidneys were greatly degenerated, as shown by the specific gravity of the urine being a degree or two only above that of water, very pale in colour, and the solids in it

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reduced to a minimum. The cause of the diminution of albumen in the later periods of desquamative disease of the kidneys is explained by Dr Johnson :—"It is not impossible that the thickened condition of the Malpighian capillaries may offer some impediment to the free escape of serum ; but as I have several times seen the urine highly albuminous in connection with extreme thickening of the vessels, I believe that a diminution in the number of the Malpighian bodies is more influential than thickening of the capillary wall in lessening the secretion of albumen." Thus, it becomes evident that a large amount of albumen in serous urine is a certain indication of disease only in its earlier and acute stages, and that, inasmuch as it becomes less in the chronic and latter stages, we must carefully consider it in conjunction with other symptoms. With reference to this subject, the following remarks, founded on Dr Prout's writings, will assist us :—In certain cases of disease the urine becomes pale, the specific gravity low, and the urinary ingredients scanty. In this diminution of the solids we are furnished with a means of recognising the serious character of the case, and that the diminution of the albumen indicates, not an alleviation of the disease, but, on the contrary, is a sign that the kidney is losing its power of separating not only the albumen, but also the ordinary solids of

health. Such a condition would be produced by a kidney in an advanced stage of “anæmotrophy,” that is, degeneration connected with a deficiency of sanguineous nourishment, a state which generally occurs before forty years of age, and so enfeebles the vital powers of renovation and resistance to disease that the slightest shock from a surgical operation is almost certain to destroy life.

If both heat and nitric acid produce a white precipitate, it is a certain sign of albumen being present in the urine. A scheme for the analysis of the urine of all stone patients is sketched at page 72.. Tests.

With reference to the source of pus when abundant, Prout writes as follows:—“When present in the urine in large quantity, and unaccompanied by mucus, or when mixed with blood, pus in general may be supposed to be derived from an abscess.” It may also be derived from chronic ulceration of the ureters, pelvis of the kidney, or bladder, and from abscess, cancer, or tubercle of the kidney, or, in large quantity, from dilated and sacculated kidney. It is highly desirable that its origin, whether from the bladder or from the kidney, should be ascertained; some conclusion may be arrived at on this question by the use of the microscope, for Beale says:—“When pus comes from an abscess in the kidney Pus.

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or from the pelvis of the kidney, it is not accompanied with crystals of triple phosphate. On the other hand, when it is derived from the bladder, crystals of these earthy salts are almost invariably present." Help will also be obtained from observing the characters of any epithelial cells mixed with it. Though a critical state of disease may generally be inferred to exist in a highly purulent condition of the urine, yet Beale has brought to notice the fact that this is not invariably the case, and has given the advice that "the existence of pus in the urine must not *per se* be regarded as evidence of serious disease."

Microscopical appearances.

The microscopical appearances of pus are thus described by Beale:—"The outline is usually distinct and circular, but it is finely crenated. Upon the addition of acetic acid, the globule increases somewhat in size, becomes spherical, with a smooth faint outline, and from one to four nearly circular spots are developed in the centre of each." The size of the pus-globule is about the $\frac{1}{3000}$ of an inch.

Diagnosis between pus and mucus.

The following means of distinguishing between pus and mucus are derived from Bowman's work. When the urine has stood for a time, the pus, like the mucus-globule, gradually subsides to the bottom of the vessel; and when shaken, readily mixes again with the liquid: as often as this

process is repeated, the urine each time after standing regains its transparent character. Mucus, on the contrary, cannot again be diffused through the urine, but forms, on agitation, tenacious ropy masses, except when from the presence of much earthy phosphate it has lost the property of cohering together, and in this case Bowman says:—"The microscope must be resorted to, in order to determine whether or not much mucus is present; the appearance and abundance of the peculiar granular corpuscles furnishing a rough index of the quantity present."

When pus and mucus coexist in the same specimen of urine, it is often difficult to distinguish between them. Mr Bowman writes:—"The form and general appearance of pus and mucus-corpuscles vary considerably under different pathological conditions of the patient, so that it is not unfrequently impossible to distinguish between them. The granules of pus appear indeed to be identical with those of mucus; the differences between the two substances being in the composition of the fluid in which the particles float."

The resemblance to the naked eye of pus to mucus is very close when the urine is alkaline, for it then becomes thick and gelatinous.

The microscopical appearances of the cor-

puscles of pus and of mucus are stated by Bowman to be very similar. He writes:—"The granules of mucus present almost precisely the same appearance under the microscope as those of pus, but are usually, perhaps, rather smaller, and less distinctly granular on the surface. The addition of dilute acetic acid renders visible the interior nuclei as in the case of pus."

As already stated, the means of distinguishing between the two substances lies in the composition of the fluid in which the corpuscles float. If there is a tolerably abundant quantity of mucus, the fluid portion of it will be coagulated on the addition of dilute acetic acid; but this phenomenon of coagulation is not seen when acid is added to the fluid portion of the pus, no change taking place, and the corpuscles being found, as before, floating freely about in the liquid. Another difference is that the liquor puris always contains albumen in solution, which coagulates by heat and nitric acid. "The fluid portion of mucus," Bowman writes, "on the contrary, contains no albumen, or merely a minute trace, and consequently when diluted with urine undergoes no coagulation when heated." In this test error must be guarded against, since albumen may be found in urine which contains mucus, but no pus.

The reaction of pus with potash, which is very characteristic, is treated of farther on.

Lastly, purulent urine is seldom alkaline at first, but is neutral or somewhat acid, becoming alkaline slowly. The reverse of this happens when the urine contains mucus, for then, even if acid when passed, it rapidly becomes ammoniacal.

Earthy phosphates frequently present to the naked eye a very similar appearance to a purulent deposit; but "may," Bowman says, "be at once distinguished by their crystalline form, and also by being readily soluble on the addition of dilute acetic acid."

Diagnosis of pus from earthy phosphates.

It is always necessary for the surgeon, when a specimen of urine coagulates under the influence of heat and nitric acid, to come to a clear conclusion as to whether coagulation is due to the admixture of blood itself or to that of serum only. The importance of this knowledge is due to the fact that serous urine is oftener a sign of degenerated and diseased kidneys than hæmorrhagic urine, and consequently more unfavorable for the success of any operation which may be performed on the urinary organs. Dr Prout mentions some of the causes of hæmaturia apart from kidney disease: he says that it may depend on malarious affections of the spleen and liver, and also on scurvy, as in these diseases the blood and the vital solids undergo changes inducing a

liability to bleeding from all the outlets of the body, and particularly from the kidneys and bladder; in such a habit of body, when the predisposition is great, a very slight cause, as, for instance, a small renal calculus, may give rise to very severe hæmorrhage. On the other hand, blood is commonly found in the urine in many of those diseases which would prevent an operation, such as acute inflammation, ulceration, or malignant disease of the kidney or bladder.

A good guide by which to recognise hæmaturia will be found in the following by Mr Bowman:—"When the fibrin, in its soluble form, is present, it usually coagulates on cooling, and causes the urine to become more or less gelatinous soon after it is passed. This spontaneous coagulation on cooling may be considered of itself sufficient proof of the presence of the fibrin of the blood. . . . The blood-corpuscles may generally be detected both in the coagulum and in the superincumbent fluid, when examined under the microscope; occasionally, however, they are almost entirely disintegrated, so that little or no trace of their characteristic form remains. . . . In urine containing blood, the albumen may in all cases be readily detected by the test already mentioned, viz. heat and nitric acid; but when any of the blood is also present it will coagulate with the albumen, giving the

coagulum a more or less decided red or brown colour.”

As above shown, the amount of albumen Solids of the urine. passed, without a thorough examination of the urine, especially of the quantity of solids excreted during the space of twenty-four hours, is an uncertain indication of the condition of the urinary organs.

The calculation of the solids discharged in the Mode of calculation. urine is best done in the manner recommended by Dr Johnson, in his work on ‘Diseases of the Kidneys:’—The urine is to be collected in a funnel-shaped vessel, the object of this being to obtain the deposit for microscopical examination, and to show conveniently the quantity the urine throws down after standing for a few hours. Then, having taken the specific gravity, measure the total quantity of urine, and calculate the amount of solids it contains by means of the following table, which shows the number of grains of solids in urine of any specific gravity from 1010 to 1030 inclusive.*

Specific gravity.	Solids in one ounce. Grs.	Specific gravity.	Solids in one ounce. Grs.
1010	10·283	1013	13·421
1011	11·336	1014	14·470
1012	12·337	1015	15·517

* The original table, printed in Johnson’s work, gives also the weight of a fluid ounce of urine of every density, but this, as not necessary to the calculation of the solids, I have omitted.

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		Grs.		Grs.
	1016	16·570	1024	25·051
	1017	17·622	1025	26·119
	1018	18·671	1026	27·118
	1019	19·735	1027	28·265
	1020	20·792	1028	29·338
	1021	21·852	1029	30·413
	1022	22·918	1030	31·496
	1023	23·981		

Johnson explains the manner of calculating the solids from this table:—“The mode of using the table is to ascertain the specific gravity of the urine, and to multiply the number which represents the amount of urine contained in that density by the number of fluid ounces passed in twenty-four hours. Suppose, for instance, that the specific gravity is 1020, and the quantity passed thirty ounces, then $20·798 \times 30 = 623·760$ grains of solids.”

Inaccuracy in above calculation.

This is the only ready way of making the calculation, and is sufficiently correct for all ordinary occasions, it is, however, by no means accurate, for the composition of the solid matters, and consequently the specific gravity, may be widely different in various specimens of urine, and therefore when a close approximation to the truth is sought for, the urine must be evaporated to dryness at a low even temperature and the solid matter weighed.

Normal amount of solids.

According to Dr Golding Bird, the average

amount of solids secreted by an adult in twenty-four hours is from 600 to 700 grains.

In the latter stages of degenerated kidney, Dr Prout has found the solid ingredients of the urine to sink to a fifth or even to one twelfth of a healthy standard.

As the amount of albumen taken singly is not an infallible sign of the condition of the kidneys, so also deficient solids do not invariably indicate organic disease of those organs ; for instance, I have known in natives of India, whose kidneys were apparently free from organic disease, the solids to fall, in one case, to 503·464 in the twenty-four hours ; in a second (a small anæmic man with gravel who came from a very malarious district), to 308·490 grains ; and in a third, a remarkable case, to 187·71 grains only, and yet the patient made a good recovery after the operation of lithotomy. In this last case, the causes of the great diminution of the solids appeared to be that the man was debilitated from the combined effect of recent malarious fever and strong purgation, and had been receiving only about eight ounces of food daily. In forming an opinion about a case when an exceedingly small amount of solids appears to be excreted by a patient whose general condition seems favorable, the possibility of some of the urine having been lost by the patient or attendants and not

Deficient amount of solids.

Not always a sign of organic disease.

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confessed to by them, must be remembered. Some loss may be unavoidable when there is complete or partial incontinence of urine from any cause, such as an unusual position of the calculus, lying partly in the bladder and partly in the prostate gland. On the other hand, the fact of a fair quantity of solid matter being found in the urine should not lead the surgeon to overlook the presence of unfavorable symptoms, such as large stone, old age, emaciation, and aspect of much debility, combined with husky weak voice like that of a person in an advanced stage of consumption; but he should always, and especially in such cases, make a complete examination of the urine both chemically and microscopically.

General analysis of
the urine.

In addition to the determination of the amount of solids excreted by the kidneys, a complete examination of the urine in most cases should be made after the following method, derived from Dr Beale's work. For analysis, the best urine will be that passed in the morning before breakfast, if the whole excreted during the day and night cannot be collected.

Reaction.

Before boiling the urine, dip a piece of blue litmus paper into it, and if reddened it will indicate acidity; but if the blue is unchanged in colour, use in the same way a piece of reddened litmus paper, or turmeric paper, and if the latter be turned brown, or the colour of the

former restored, it will show that the urine is alkaline.

The inference to be drawn as to the nature of the calculus from the reaction, is that if the urine is acid the stone is probably either a uric-acid or oxalate-of-lime one : most likely the former, as the more common of the two ; while if the reaction is alkaline the following quoted from Mr Bryant's ' Surgery ' will aid the surgeon in drawing a correct conclusion :—" If the *urine be alkaloid* from *fixed alkali*, as indicated by the permanent change in the test paper, the earthy phosphate or the carbonate-of-lime calculi are indicated ; if from the *carbonate of ammonia* the result of decomposition of the urine, the mixed phosphates, that is, that a crust of these is being deposited upon an unknown nucleus."

Prout states that the natural secretion of urine varies from thirty ounces, with a specific gravity of 1025, in the summer, to forty ounces in the winter, with a specific gravity of 1015. The quantity and specific gravity of the urine in a healthy condition of system are thus seen to compensate each other.

Amount of urine, with specific gravity.

Beale in his work has stated the natural quantity of the secretion of urine, and consequently the amount of solids excreted, at more than this.

When the specific gravity is very high, the presence of sugar or an excess of urea may be

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suspected ; when, on the contrary, it is very low—1005 to 1012 or 1014—the urine will often contain albumen.

Tests for albumen.

If both heat and nitric acid produce a white precipitate, it is a certain sign of albumen being present in the urine. Heat (140° to 167° Fahr. are sufficient) readily coagulates the albumen when the urine is acid ; on the contrary, if alkaline, it will not do so, but throws down the phosphates instead, the albumen remaining in solution. It is therefore necessary before boiling alkaline urine to neutralize it with an excess of nitric acid ; but if this should be neglected, the acid can be added after the application of heat, and the phosphates will then be dissolved, while the albumen is thrown down. The only error which could occur when both these tests were employed would be from not using a sufficiency of the acid, since a small quantity of precipitated albumen may be redissolved upon agitation in urine of slight acidity only : it is, on this account, needful to add as much as ten to fifteen drops of the strong nitric acid to one drachm of urine.

Test for pus, &c.

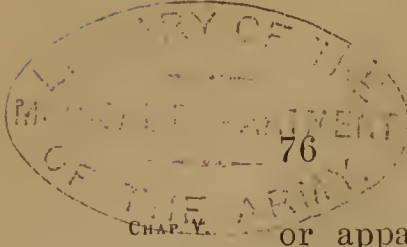
Heat and nitric acid give somewhat similar results with purulent urine to what they do with serous urine ; but the former can at once be distinguished by adding liq. potassæ, instead of the nitric acid, to the opaque urine after boiling, when

the purulent fluid will at once become clear, the serous fluid remaining unchanged.

Solution of potash added to pus changes its characters to a viscid and stringy substance, but does not exert any such action on mucus.

This solution may also be used to distinguish between pus, phosphates and lateritious deposit, the last named consisting of urate of soda, urate of ammonia, &c. Beale's method is the following:—"The clear supernatant fluid is to be poured off, and a little of the deposit transferred to the test-tube. Upon the addition of about half the bulk of solution of potash, one of the three following points will be noted:—1. No change will be produced, in which case the deposit consists entirely of *phosphate*. 2. The mixture will become *clear*, and very *stringy* or *viscid*, so that it cannot be poured from the test-tube in drops. In this case we may be certain that the deposit consists of *pus*. 3. The solution of potash may cause the mixture to become clear but not viscid, in which case *urate of soda and ammonia* enter largely into the composition of the deposit. . . . If liquor potassæ gelatinizes the mixture, but does not render it clear, it is probable that both *pus* and *phosphates* are present."

Though recommending the use of the micro-Microscopical examination. scope as an aid in diagnosis, I do not think a real Caution.



or apparent absence of casts of the uriniferous tubes should lead the surgeon to look favorably on the case when all the other symptoms concur in proving it an unfit one for operation, for the failure in discovering the object may depend on various causes, such as a defective microscope, want of expertness in manipulating it, or non-formation of casts notwithstanding the presence of organic kidney disease. On the other hand, Dr Beale gives, in his work, a long list of matters of extraneous origin which may, without caution, be mistaken for urinary deposits.

Object-glass.

The most useful object-glass for the examination of casts of the tubes, epithelium, and most other urinary deposits, is the quarter of an inch.

Manipulation of microscope.

In searching for granular and perfectly transparent casts, Beale has made the useful suggestion that it may not be possible to see them until the greater part of the light is excluded from falling upon the field of the microscope.

Collection of deposit.

Casts of the uriniferous tubes when present are frequently accompanied by much epithelium, and will generally be found in the upper part of the deposit, and therefore a little of the deposit from that part should be taken for microscopical examination.

Cause of formation of casts, and inferences to be drawn from their presence.

Beale writes:—"In most cases in which albumen occurs in the urine, tubes are also found; for with the serum a certain quantity of coagu-

lable material transudes or is found in the tube, and this becomes solid while it lies in the tube, of which it takes a mould, and entangles in its meshes any loose bodies, as particles of epithelium, &c., which may happen to be in the tube at the time." The inferences drawn by this author are, that if the casts are perfectly transparent or if entirely absent the case is favorable; but that if the kidney is diseased, evidence to some extent characteristic of the form of lesion will often be afforded by the appearance of the cast.

There are several different sizes of casts, their Size of casts. diameter varying with that of the canal of the uriniferous tube in which they are formed; the finest and narrowest are those formed in a tube the canal of which is contracted from the presence of much epithelium; while the broadest results from a tube which has lost all its epithelium, the basement membrane alone being left. There are likewise casts of medium size, and these are by far the most commonly met with.

1. Casts about the $\frac{1}{700}$ of an inch are con- Medium diameter. sidered to be of a medium diameter. Of these the granular epithelial casts consisting entirely of disintegrated epithelium occur, sometimes abundantly, in cases of chronic nephritis. When these casts contain oil-globules they denote fatty degeneration of the kidney.

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Large diameter.

2. Casts with a diameter of $\frac{1}{500}$ of an inch are large. The most common representative of this cast is the large waxy cast, indicating a state of waxy degeneration of the kidney.

Small diameter.

3. Casts with a diameter of $\frac{1}{1000}$ of an inch only are small ones, and are met with in desquamative nephritis. They are formed in tubes with an entire epithelial lining. They are named small waxy casts, and have the same smooth glistening appearance as a piece of elastic lamina of the cornea.

Deductions from appearance of the casts.

Granular and perfectly transparent casts, Beale says, "would indicate that the kidney was becoming small and contracted, while oil casts occur when it is often of large size and fatty. . . We must be prepared to meet with several varieties of casts in one case, and must ground our opinion in great measure on the relative number of any particular kind of cast."

Nature and usual size of each kind of calculus, with mode of its fracture under crushing.

After having completed the examination of the patient, and ascertained that he is fit for operation, it is well for the surgeon to decide from the chemical and microscopical characters of the urine what the probable nature of the calculus is, to enable him to judge whether it is of a kind liable to be broken accidentally, or which can easily be crushed if necessary. Besides, by knowing the texture of the stone he will have, in addition to sounding, a guide as to its probable

size. Thus, if crystals of uric acid or the octohedra of oxalate of lime were found as a persistent deposit, it would indicate that the calculus was either composed of uric acid or oxalate of lime; that it was most likely of medium size, and both exceedingly hard and compact in texture. He knows that the former would necessitate the exertion of great force, and fracture into wedge-like and very sharp splinters; while the latter, also breaking only under great power, would form irregular jagged masses.

The oxalate of lime calculus is much the most difficult of all descriptions of stone to break. Sir H. Thompson says that though it is possible to crush it with a lithotrite when under one inch in diameter, yet when above that size it will generally be impossible to do so, and writes:—"In the case of a large oxalate of lime stone, it is like laying hold of a piece of iron—you make no impression upon it."

If the deposit were urate of soda, the calculus would be formed of this substance, and would consequently be rather larger than the above. It would also be more friable, breaking into small granular masses without the use of so much power as they require.

The mixed calculus is composed of alternating layers of either uric acid, or urate of soda with phosphatic deposit, and its existence is deter-

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mined by ascertaining the characters of the deposit which has been persistent for some days or weeks. It is a larger kind of stone than the last, and breaks more easily on account of the unequal resistance of its several layers, the phosphatic constituent granulating, and the thin alternating layers of uric acid, or of the urate of soda, fracturing into flat and shell-like pieces.

Triple phosphate calculus.

Alkaline urine charged with earthy phosphates, but without adhesive mucus, shows that a calculus of the triple phosphate (or sometimes an external layer only of this substance) is present; that it is probably of large size and can easily be broken.

Fusible calculus.

If alkaline urine contained not only triple phosphate, but also adhesive mucus, there would be a fusible calculus generally of a large size. It is the most brittle of all stones, and is composed in part of triple phosphate and partly of phosphate of lime, the latter being formed from the morbid mucus secreted by the mucous membrane of the bladder when diseased.

Nature of stone as affecting the condition of the lining membrane of bladder.

Having determined the nature of the calculus, the surgeon will find in the knowledge thus gained an additional confirmation of the fitness or otherwise of the case for operation, for Prout says: —“Hard stones, like those of the mulberry and lithic acid varieties above mentioned, are usually connected with a sound and quiescent state of the

bladder; whereas soft stones, which usually consist of the phosphates, are often connected with an irritable or diseased condition of the mucous membrane of that organ."

If the case is found to be one of multiple calculi there will be a strong probability of their consisting of lithic acid.

Nature of multiple calculi.

According to Prout, multiple calculi are rarely composed of oxalate of lime or of the phosphates, and with reference to the latter he says:—"Nor have I seen a plurality, *i.e.* more than two or three large concretions of the phosphates in the bladder at the same time; though the presence in that organ of small irregular fragments, consisting of the phosphates in an imperfectly crystallised form or in a plastic mortary state, is very common."

CHAPTER VI

PREPARATORY TREATMENT

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THE advisability or not of much preparatory treatment is a subject on which there is a difference of opinion among lithotomists, and one on which I do not feel competent to speak decisively. It has not been my usual practice to delay the operation for more than a day or two in India, as a native of that country is apt to become discouraged and to abscond if quick relief is not afforded to his sufferings.

Sir H. Thompson looks upon preparatory treatment as important, and many lithotomists in England have referred their unusual success to the careful preliminary treatment to which they subjected their patients.

There will be no doubt of the necessity of a short delay before operation when the patient is suffering from increased sensibility of the bladder resulting from a "fit of the stone" brought on by the fatigue of a long journey or other cause.

Brett, in his work on 'Surgery in India,' does not think preparatory treatment needed in any,

"Fits of the stone."

Preliminary treatment
in phosphatic dia-
thesis.

except in patients with the phosphatic diathesis. In these, he says, the local and general irritation is such that they cannot be operated upon with safety until by the employment of muriatic acid, opium with hyoscyamus, suppositories, &c., their severe sufferings have been alleviated.

Instead of continuing the use of opiates (which are apt to block up the secretions) in these or other cases when the patient has acquired the habit of taking them to assuage his sufferings, I think it would sometimes be better gradually to relinquish the use of them, substituting strengthening food, quinine and iron, or other tonics, with wine if indicated, such means having been often found to tranquillise the nervous system as much as narcotics.

In affections of the kidney of a hæmotrophic kind, common in middle-aged and plethoric individuals, with serous urine of a high specific gravity and depositing the lithate of ammonia, Dr Prout recommends that a course of preparatory treatment should be adopted before an operation is performed, lest acute inflammatory action be superinduced in the kidney.

Serous urine in hæmotrophic kidney.

There are some conditions which should always prevent an immediate operation: one is constant irritative fever depending on acute or subacute congestion of the kidneys, bladder, or prostate; and another is great emaciation and debility from

Irritative fever and emaciation from deficient nourishment.

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want of food. If the latter class of patients are operated upon in India without preliminary feeding up, I have observed that, even if they escape with life, they run a risk of sloughing of the cornea as a consequence of the exhausted state of the constitution.

CHAPTER VII

THE LATERAL OPERATION

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THE lateral operation consists of a number of stages which succeed each other in regular order, the principal of which are :—1st. The preparation of the patient, introduction of the staff, administration of chloroform, and tying the patient's hands and feet together in the lithotomy position. 2nd. The external incision. 3rd. The cutting upon the staff into the membranous portion of the urethra. 4th. The division of a portion of the prostate and neck of the bladder. 5th. The introduction of the forceps into the bladder, and grasping of the stone. 6th. The extraction of the calculus. Each of these stages will be found described in Chapter VIII in more detail than could be done in the present one, without making the description of the operation of an objectionable length.

The patient should receive a dose of oil the day before, and an enema of warm water must be administered to him an hour and a half before the operation. In the case of a very debilitated

Aperient and enema.

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person, however, the aperient is undesirable, since it may weaken him; and in young timid children it is preferable to omit the injection, lest they should be injured during their struggles by the nozzle of the enema tube, and to depend for the emptying of the rectum on the introduction and gentle movement of the index finger in that gut.

Examination of prostate, &c.

Before the enema is administered to the patient, the surgeon should take an opportunity of measuring the outlet of the pelvis in its several diameters by tracing the course of the rami of the pubis and ischium on both sides, and should introduce his finger into the rectum to ascertain its condition, and the size of the prostate with its depth from the surface. If not previously done, the skin of the perineum of adults should now be shaved.

Urine to be retained or the bladder injected.

After the enema has been administered the urine must be retained by an adult for the full hour and a half before the operation, and by children for one hour only; but if from irritability of the bladder, or from fractiousness, as in the case of a child, this cannot be done, Gross recommends the surgeon to tie a piece of tape loosely around the penis to prevent the escape of the urine. A preferable plan I think is to direct an attendant to hold the penis; or, if this is undesirable, having first drawn off the

remaining urine, to inject the bladder with tepid water, *if it can be done readily and gently*,—generally from two to six ounces according to age. Half of these quantities will be sufficient for elderly subjects in whom the muscular power of the bladder is weakened, and for any patient when the calculus is of small size.

No injection should be given when there is a difficulty in the introduction of the catheter; when there is the least suspicion that the catheter is in a false passage, or when the bladder is so irritable as to be incapable of retaining any fluid; but the operation may be proceeded with, and will be found almost as easy and successful as if the bladder contained fluid.

I may add that the injection ought invariably to be given gently, no more fluid being forced into the bladder than it can easily contain; and to a struggling patient it will sometimes be safer to omit it, lest the coats of the bladder should be injured by the point of the catheter.

The following are the instruments and medicines which are required for the operation; particulars as to the most approved kinds of the former will be found at page 133.

Instruments, lithotomy table, &c.

Sounds, including a straight one, and one with a short curve; lithotomy scalpels; straight probe-pointed bistoury; staffs; forceps of several sizes

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and shapes ; eight-ounce or three-ounce syringe, with suitable catheters for injecting the bladder by the urethra ; scoop ; canula for plugging ; lithotomy garters ; ligature silk ; artery forceps ; tenaculum ; curved needles ; lint ; vessels containing hot and cold water ; tinct. of iron ; liq. ammoniæ ; brandy ; a blunt gorget when obtainable. A firm table must be provided, about two and a half feet in height, and from two feet six inches to three feet in width.

If the lithotomy scalpel to be used is not bevelled off at the back near the point, so as to glide readily in contact with the groove of the staff, it is well to run its point along the groove, so that, if it catch, either the groove of the staff may be smoothed, or the point of the knife blunted. If the latter be necessary, it must be done very slightly, lest from its bluntness it become entangled in, without cutting, the mucous membrane of the urethra, and thus perhaps tear across the membranous portion of the urethra and fail to enter the neck of the bladder.

Introduction of the
staff.

The staff ought to be passed before chloroform is given or the patient tied up. As large a one as the urethra will admit with ease should always be selected, except for very young children, in whom a staff which lies loose within the bladder is preferable, as a large one fills up that part so completely as often to render the inser-

tion of the finger after incision a matter of difficulty.

If the patient has already been sounded, the staff may at once be passed; but in the case of young children and timid adults, when, to avoid alarming them, no previous sounding has taken place, a sound should be passed and a proper examination made before the staff is introduced.

The surgeon, having selected the staff, passes it into the bladder of the patient, and endeavours to strike the stone with it so as to elicit the characteristic click.

Sounding with the staff.

If, after a fair search, with the adoption of the expedients suggested at page 39, it cannot be heard or felt, the operation must not be proceeded with; but when a calculus is unmistakably present in the bladder, the staff must be entrusted to an assistant, who, standing on the left side of the patient, and using his right hand, should hook or draw it up under the symphysis pubis at the time of the operation in such a way that its concavity may rest firmly but lightly against that part, the handle being kept perpendicular, and not allowed to deviate to the right nor to the left of the middle line: the direction of the instrument must correspond as exactly as possible to the curve of the urethra, its convexity neither being made to project on the middle line of the perineum nor towards the left ischium. One and

Manner of holding the staff.

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a half or two inches of the staff will thus be made to project into the bladder in the best direction, in relation to the neck and walls of that viscus, for the safe passage of the knife along its groove in making the internal incision.

The assistant must be warned to guard the coats of the bladder against injury from the point of the staff, while the patient's body is being moved about in tying him up, and during any struggling to which the administration of chloroform may give rise. This assistant with his left hand should hold up the scrotum and penis out of the way of the operator.

Administration of
chloroform.

Tying up of patient
in the lithotomy posi-
tion.

The next step is to administer chloroform, and as soon as partial insensibility is produced, the administration, meanwhile, being continued, the patient's hands and feet must be bound together in the lithotomy position, *firmly*; unless he be very old or crippled by rheumatism or other disease, when the garters may be applied *more loosely*: his body is then placed at the end of the table, in such a position that his nates project slightly beyond it, with his feet resting upon its edge.

Manner of holding the
patient.

In this position the patient's body must be held from the beginning to the end of the operation by an assistant standing on either side of the table, who, fixing the patient's knee into the hollow of his own armpit, and then placing his upper arm against the inner side of the bound limb,

hugs it closely to his own chest, and throwing the weight of his chest upon the knee, presses it outwards, while the one hand should assist the other to draw the foot outwards, and fix it against the edge of the table. At the same time he must keep the patient's buttocks from tilting upwards; the body immovably fixed in one position, and the perineum square to the front.

These assistants must be enjoined to be careful not to make any pressure on the chest of the patient.

Another assistant must stand behind, with a hand resting on either shoulder of the patient, ready to prevent any movement of his body away from the operator; and if the pelvis cannot be immovably fixed by any other means, two additional assistants should respectively press either femur firmly down into the acetabulum.

The following, on the best mode of making the External incision. external incision, is more especially for the guidance of beginners; but for others, after they have performed their twenty or thirty cases, greater licence may be allowed, and they may feel safe in cutting more boldly, perhaps in touching the staff in their first incision, though they should in such a case commence the incision a little farther to the left of the raphé than I have recommended. While myself preferring to incise the integuments only by the first stroke of the knife, I think timid

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shallow cuts should be avoided in making the external incision.

The operator, having first satisfied himself that the point of the staff has not slipped out of the bladder, and having introduced his finger into the rectum to cause it to contract, proceeds to make the first or external incisions. Seated, or resting on his left knee, and placing the thumb and forefinger of his left hand on the left side of the perineum to maintain the raphé in the central line, and to render the skin tense, but avoiding unnecessary displacement of it upwards, he then penetrates the integuments about one line's breadth to the left of the raphé of the perineum, and five lines to one inch and three quarters above the anus, carries the blade of the knife downwards and outwards midway between the anus and tuber ischii, and makes an incision of the skin and superficial fascia one and a half to three and a half inches in length. The length of this incision and the point of its commencement will depend on the nature of the case and the age of the patient; for if, in an adult, the bladder be deep from enlarged prostate or obesity, or if the stone be large, the long incision commencing at the full height above the anus should be made; but in spare adults with small stone, and in children, a limited one will suffice. In ordinary cases of stone occurring in adult patients, an

incision of three inches in length is made, commencing one inch and a quarter in front of the anus.

The surgeon should now insert and retain his left forefinger within the rectum to keep up contraction of it and to guard it from injury, while he deepens the middle and lower parts of the wound, incising any fibres of the transversus perinei muscle which may be seen extending in a prominent manner across the line of the incision, and which in muscular subjects sometimes form a bar stretching across the passage through which the stone will have to be extracted. Care, however, must be used in doing this, not to wound the coats of the rectum which lie immediately underneath the muscle, and sometimes even bulge into the wound while it is being made. It is very necessary to cut these fibres if the stone be large, the patient muscular, or the bladder deep from obesity, or enlarged prostate: they will be found (by looking for them at a point in the wound a little above the level of the anus) extending from the situation of the tuberosity of the ischium towards the raphé of the perineum, and generally lying in an adult at a depth of the distal phalanx of the index finger from the surface, *i. e.* about one inch and a quarter.

Then removing his finger from the rectum and passing it into the upper angle of the wound to

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press aside and depress that gut, the surgeon continues the incision up to the staff where it lies in the membranous portion of the urethra; but avoids extending it in front near the raphé, the skin and superficial fascia being here only incised.

Cutting into the
membranous portion
of the urethra.

This part of the external incision, namely, the cutting upon and lodging the point of the knife in the groove of the staff, is one which I have repeatedly seen young nervous operators fail to accomplish, either from cutting so superficially as not to get up to the staff, or so deeply as to get to one side of it. The only safe and sure way of making it, is for the operator to keep carefully present to his mind the situation of the under border of the symphysis pubis as the point towards which the incisions are to be directed, and, noting the position of the bulb of the urethra, to cut cautiously and steadily (taking care that progress is made), upwards and towards the subpubic arch, incising *resisting* tissues, but pushing others aside until the staff can be felt, and, then clearly making out the two edges of the groove at a point a little behind the arch, to hitch the nail of his left forefinger between them, and, cutting in a rather bold manner upon the staff, by the side of the nail of the finger, to incise the membranous portion of the urethra to the extent of two or three lines,

lodging the point of the knife fairly in the groove of the staff about three lines in front of the prostate.

Knack is required in making these incisions, for on account of the laxity of the tissues, and especially of the mucous membrane of the urethra, the knife may displace the parts without cutting them. It is therefore prudent, after lodging the knife in the groove, to see that it is in actual contact with the staff free from uncut mucous membrane; this may be known by the feel and ring of metal on giving a slight motion to the point of the knife by means of rubbing it backwards and forwards in a wriggling manner in the groove.

If hæmorrhage should come on either during these or the deep incisions, it is the most judicious course to continue the operation, meanwhile controlling the bleeding (if serious) by pressure, and immediately after the extraction of the calculus to apply the treatment recommended in the chapter on Hæmorrhage.

Should the rectum become prolapsed while the incisions are being made, it may be pressed back and retained by an assistant with a pad applied on the right side of the perineum; but if there should be a difficulty in keeping it in its proper place, it may be left out of position while the operation is proceeded with.

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Internal or deep
incision.

Using the same scalpel with which the external incisions were made, and being satisfied that its point has fairly entered the groove of the staff, the operator now requests the assistant to hold the staff, or, as I prefer for reasons stated in Chapter VIII, takes the handle of the staff in his own left hand, hooking it well up under the arch of the pubis. Then somewhat lateralising* the blade of the scalpel so that its edge may be directed downwards and outwards to correspond with the direction of the external wound, and keeping its handle as parallel as possible with the staff, with the point steadily pressing up into the groove, he cuts with or pushes it along the groove through the prostate gland and neck of the bladder, until the escape of urine or water, the arrest of the knife at the end of the groove, or the cessation of resistance by the uncut prostate gland and neck of the bladder indicate that the bladder is entered.

To reach this viscus it is generally necessary in adults to pass in the point of the knife to a depth from the surface of two and a quarter to two and a half inches, but beyond this when the perineum is unusually deep.

* Sir H. Thompson approves of the knife being lateralised by Key's method, and if the operator thinks he can do it more conveniently so than in the ordinary way, he should follow the directions of Key: "With an easy simultaneous movement of both hands the groove of the director and the edge of the knife are to be turned obliquely towards the patient's left side."

The incision thus made, which in the adult must not extend beyond seven or nine lines (and in many cases should not exceed five lines in extent) from the urethra outwards and downwards through the left side of the prostate gland, will be very limited, and will not much exceed the breadth of the blade of the scalpel if, while it is being pushed along the groove of the staff, its point is not allowed to leave the guidance of that part, or its handle to form a large angle, but is kept as nearly as possible parallel with it. Though in this incision the apex of the prostate gland is always completely divided, yet, if the point of the knife is not permitted to leave the groove, a few lines or rim of glandular tissue with the capsule will be left intact at the base of the gland, and the only part of the bladder which will be cut will be the unyielding ligamentous issue at its neck: the extent of the incision through these parts depending, as above stated, upon the breadth of the blade of the scalpel, and the angle at which it is pushed along the staff into the bladder.

Provided the knife is carried sufficiently far along the groove of the staff to notch the ligamentous band at the neck of the bladder, a limited incision of seven to eight lines, which at first will not be much more than sufficient to admit the forefinger, will allow of dilatation being carried to any required extent, partly by the finger, but

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chiefly by the forceps, during the extraction of the calculus, and will admit of the removal of a stone, according to Liston, of "from three to nearly five inches in circumference in one direction, and from four to six in the largest." A stone of this size, however, experience has taught me, cannot always be extracted with safety by the lateral operation without the adoption of some other expedients; though, in a few exceptional cases, calculi of even rather larger dimensions may be successfully brought away; the difference between the two classes of cases depending upon the state of relaxation or dilatibility of the neck of the bladder from constitutional causes or from peculiar shape of the stone. Whenever, therefore, there is so much obstruction to the exit of the calculus, either from its large size, from the want of relaxation of the parts, or from other causes, that it cannot be overcome without the employment of force sufficient seriously to bruise the parts about the neck of the bladder and prostate, the attempt should on no account be continued until the right side of the prostate has been incised, or the other means recommended at page 180 have been employed.

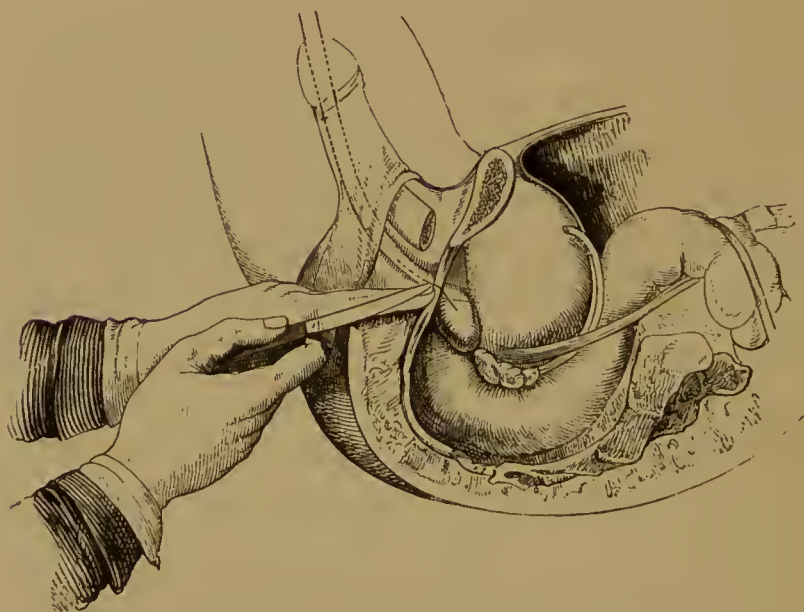
The proceeding of passing the point of the scalpel along the groove of the staff to divide the prostate and neck of the bladder to the exact extent desired, is one of the utmost delicacy,

and is often rendered one of difficulty and danger by a bad staff-holder, who may unconsciously withdraw the staff outside the neck of the bladder, or press it down upon its posterior wall, causing this part to be wounded by the point of the knife in its passage along the groove. At other times the incisions may be so limited as to leave the unyielding elastic tissue at the neck of the bladder untouched, or, on the contrary, if force be used, the point of the scalpel may slip out of the groove of the staff, or may plunge forward so deeply as to wound the walls of that viscus. The safety and facility with which this important part of the operation is performed are much increased if the operator hold the handle of the staff himself, as it is only by this means that the knife and staff can act in perfect unison, and the difficulties and dangers above mentioned be avoided. He can thus, if the point of the knife be arrested by a notch in the groove, alter, without the use of force, the relation of the knife and staff to each other in any way required to enable the former to pass on, either by slightly raising the handle of the knife, or by giving the point a wriggling motion in the groove, or by slightly drawing it back and then pushing it forwards again.

The manner of holding the lithotomy scalpel in making the incisions above described is of some

Manner of holding
the scalpel.

importance. In the external incisions as well as in cutting through the membranous portion of the urethra into the groove of the staff, it ought to be held like an ordinary scalpel, and this way of holding it should be retained in making the internal incision in children, and in adults with shallow perineum; but where the perineum is



(Liston.)

FIG. 5.—Showing the position of the hand and knife.

deep from obesity or enlarged prostate, it is better, having carefully fixed the point of the knife in the groove of the staff, to alter its position in the hand so as to place it above the fingers and below the thumb in the way a lance is grasped (fig. 5): the section of the prostate can then be made and the bladder entered by one

steady cautious push of the knife forward along the groove of the staff, whereas if the scalpel be held in the ordinary way it will require many cuts to penetrate to the required depth. But while recommending that in this state the scalpel should push rather than cut its way along the staff, I must warn my readers against thrusting it forcibly upwards to overcome obstruction in its passage along the groove, lest it dart forward and wound important parts; but, if they find its point arrested, I would advise them to induce it to pass on again by proceeding a little more slowly, and giving the point a wriggling motion, or by the other means mentioned in the preceding paragraph. In these cases of deep bladder it may be necessary to pass the knife to a considerable depth from the surface, as much as $4\frac{1}{2}$ inches in some cases, before the tissues at the neck of the bladder can be sufficiently notched to allow of the introduction of the finger into the vesical cavity; but there will be no risk of pushing it in so deeply as to wound the interior of that viscus, if gentleness and steadiness be used; if the groove of the staff be closed at the end so as to arrest the point of the knife, and if the depth from the surface to which the latter penetrates be noted, so as to guard against the possibility of its point riding over and so passing beyond the end of the staff.

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Operation without
incision of neck of
bladder.

Before leaving this part of the subject I would mention, although I have very seldom adopted the practice myself, that it is quite possible to perform the operation, whether in adults or in children, for the smallest-sized calculi, by inserting the scalpel into the prostatic urethra only, without incising any portion of the neck of the bladder, the latter being dilated by the finger or by a polypus forceps.

Withdrawal of the
knife from the blad-
der.

The internal incision being completed, the surgeon must, without cutting laterally, carefully withdraw the scalpel, keeping it as parallel as possible with the staff and its point in contact with the groove while passing it backwards through the neck of the bladder and prostate gland; and while doing this he must press aside the rectum to prevent its being injured by the edge of the knife.

Introduction of the
finger into the bladder.

On the withdrawal of the knife, and without delay lest the remaining fluid escape out of the bladder, but before removing the staff and being guided by it, the operator must slip his left forefinger into the bladder to search for and examine the calculus, and to ascertain the sufficiency or otherwise of the internal incision in relation to the size of the stone. If he think that the calculus is not too large to admit of its safe extraction through the incision already made, he may direct the assistant to take away the staff;

but if satisfied that enlargement of the wound through the *left* side of the prostate, or, from the great size of the calculus that an incision through the *right* side also of the gland is required, he should make it before the withdrawal of the staff.

The staff having been removed, the operator should dilate the neck of the bladder with his left forefinger, and then, having ascertained the position of the calculus in the bladder (generally near the neck), so as readily to direct the forceps to it, and hooking or gently pulling the neck of the bladder downwards, he must introduce the forceps (previously warmed and oiled) along the finger into the bladder, by insinuating them into the wound in close contact with the palmar surface of the finger, and passing them upwards in a slow and deliberate manner so as gradually to dilate without rupturing the internal incision: on arriving at the bladder, he should slip them into its neck simultaneously with the withdrawal of his finger.

At the moment the forceps enters the bladder, if the surgeon open them and give a slight scooping motion to the blades, he will often be able to catch the calculus as it is carried between them by the urine coming away with a gush; if he fail in this, he may, in many instances, when able to touch the stone with the forceps, succeed in seizing it at once on making a second attempt, by opening

Introduction of the
forceps.

Seizure of the calculus.

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the blades pretty widely, and then slowly turning them over to the side on which the calculus is felt and closing them; or if not, he will in all probability be able to do so, by somewhat elevating the handles of the forceps, gently opening the blades, and pressing one of them on the wall of the bladder below the calculus: he must then slightly shake the instrument to cause the stone to drop between their blades. One very necessary precaution in using the forceps is not to open them until they are within the cavity of the bladder, and never to expand the blades suddenly and with a jerk, lest they tear the prostate and neck or other part of the bladder. In other cases the calculus is not so easily felt, and then the operator must search for it with the closed forceps, using them for this purpose not with rough and awkward movements, but gently and methodically as he would a sound, and directing them in the first place to those parts of the bladder where calculi are most commonly situated, namely, the neighbourhood of the neck and the depression behind the prostate; if not met with there, he must thoroughly explore the remaining parts of the cavity, and if successful will, with little doubt, be able readily to seize it in the way above recommended.

When all the urine or water has escaped before the surgeon has succeeded in laying hold of the

Mucous membrane
pinched between the
forceps and stone.

calculus, he should proceed with much gentleness, as in this case the bladder oftentimes contracts closely around the stone, so that the mucous membrane if rugous or relaxed may readily be pinched up. In view of the possibility of this accident having occurred, the operator should, before proceeding to extract (and it is wise to do this in every case of lithotomy), first rotate the forceps a little on their own axis to convince himself that nothing else is included, freedom of movement, and the absence of the sensation of the inclusion of a soft body, implying freedom of the bladder; but if any doubt still remain in his mind, he should, during an interval when the forcing efforts of the patient are suspended, slightly relax the grasp of the forceps upon the stone (without losing hold of it altogether) to allow the escape of the mucous membrane if unfortunately nipped up.

Another precaution is occasionally necessary, before extracting, when the handles of the forceps remain widely separated, indicating that the calculus, if a moderate-sized one, has been seized by its long diameter, or too near the joint of the blades—the surgeon should introduce his forefinger (or a strong probe) along the blades of the forceps, or at times into the rectum, and then slightly relaxing his grasp of the stone should push or turn it into a more favorable position;

Stone seized by
long diameter.

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but failing in this, he must let it drop and endeavour to catch it again in its short diameter.

Calculus to be grasped fairly.

In seizing a calculus with the forceps, care should always be taken to grasp it fairly, for if the blades catch merely an end of it, it will slip out of their grasp on extraction being attempted.

Stone hid in fold of mucous membrane.

If the operator does not succeed in finding it with the closed forceps, he should slowly expand the blades horizontally so as slightly to stretch the lining membrane of the bladder, and if a little stone is hidden in any of its folds, it will most probably drop out and fall to the floor of the cavity, where it may be caught.

Obstacles to grasping the stone.

Sometimes, however, difficulty is experienced in seizing it from various special causes, and when this is the case the operator should use the forceps with much gentleness, lest they irritate the coats of the bladder which are often contracted closely around the calculus.

Enlargement of the prostate gland.

Enlargement of the prostate, especially of the middle lobe, behind which the stone has lodged, is the most common form of obstacle to the seizure of the calculus; but may often be overcome by the curved forceps, with which the depression behind the prostate can be explored.

Flat stone.

A *flat stone* is a difficult one to seize from its lying flat on the floor of the bladder, and requires that the surgeon should raise the handles of the forceps sufficiently to cause the blades to sweep

the whole of the lower surface of the cavity of the organ; but if still unable to lay hold of the concretion, he should endeavour to do so with *the curved* forceps or the scoop.

A round calculus, especially if smooth or much tuberculated, may give trouble on account of the liability of the straight forceps to slip off it; but a good hold may often be obtained with the *curved* forceps or the scoop. Round calculus.

Whenever delay takes place in seizing a calculus, aid should be given to the endeavours by inserting the finger in the rectum in order to push the concretion towards the forceps. Aid to be given by finger in rectum.

The diminutive size of a calculus may be a source of difficulty, for it may be so small as to lie hidden in the folds of the mucous lining of the bladder, and after being seized may continue to escape from between the blades of the forceps; the surgeon must then have recourse to the scoop, but, in employing it, should avoid repeated scrapings of the interior of the bladder, which would excite great irritation of its lining membrane. Small size of the calculus.

Spasm of the neck of the bladder may hinder the surgeon in his attempts to grasp the stone, by preventing the expansion of the blades of the ordinary forceps. In order to overcome it, the full influence of chloroform must generally be induced, while gentle and continual pressure of the expanded forceps is made on the inside of the Spasm of the neck of the bladder.

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neck of the bladder, and, if necessary, the part should again be dilated with the finger. Before, however, resorting to these means for causing dilatation, which are not unattended with danger of bruising the neck of the bladder, I have sometimes found it possible to accomplish extraction with the smallest sized forceps, notwithstanding the contracted state of the part.

Spasm of bladder.

Spasm of the bladder, causing contraction of its cavity closely around the calculus, may interfere with the passing of the blades of the forceps between the stone and the walls of the bladder without risk of injuring the latter. In this, as in the last case, the full influence of chloroform should be established, and when the spasm has somewhat subsided, the operator may often with patience and dexterity insinuate, or, as it were, coax the blades of the forceps between the calculus and the walls of the bladder, remembering that, under these circumstances, there is special liability for hypertrophied fibres to be pinched between the blades of the instrument. If the operator fail after a reasonable time in overcoming the spasm, it is safer to suspend his efforts until the next day, in the hope that, in the interval, the parts may have become relaxed, than to go on irritating a diseased, and often highly sensitive, bladder with fruitless attempts.

A calculus lodged behind the symphysis pubis

in the upper part of the bladder may prove a difficult one to seize. Here the operator must direct an assistant to make firm pressure with manipulation above the pubes, and, having raised the pelvis of the patient, he will generally be able to grasp the stone with a well-curved forceps (sometimes curved almost at right angles); or if not, he may be able to bring it down by injecting the bladder with warm water.

It will usually be found impossible to lay hold of an encysted or a sacculated calculus without causing dangerous injury to the adjoining parts of the bladder; the further consideration of these, and the subject of adherent calculus, will be found in a subsequent chapter.

Encysted, &c.,
calculus.

In the columnar bladder the surgeon should be very careful not to wound the projecting columns, and in order to guard against this, should, before attempting to seize the calculus, introduce his forefinger into the bladder to disengage the stone from any recess between the columns in which it may be entangled; while, if beyond the reach of his finger, he should try to extricate it by the scoop, or by injecting the bladder with a full stream of warm water.

Columnar bladder.

The operator must grasp the calculus firmly enough to prevent its escaping from between the blades of the forceps, but not with such strength as to crush it, and having caused the convexity

Extraction.

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of the blades of the forceps, respectively, to look obliquely upwards and downwards, so as to correspond with the line of the incision in the left side of the neck of the bladder, should then commence to extract by slowly and deliberately moving the forceps alternately up and down and from side to side with such a degree of pulling and, if necessary, gentle twisting as will cause the textures to yield gradually on all sides. While doing this, care must be taken that traction is made well down towards the floor of the incisions, in which direction the greatest amount of dilatation can be obtained; and that the neck of the bladder and the prostate are not allowed to descend along with the calculus, but are, if necessary, supported or pushed back by the forefinger of the left hand.

Incision too limited,
necessitating enlarge-
ment of original
wound.

Should it happen that an unusually limited incision has been made in the left lobe of the prostate, so that the calculus, although a *moderate-sized* one, cannot be extracted without the employment of much force, the operator should endeavour again to dilate the wound with his finger, or, if this prove insufficient, may slightly extend it by incision with a probe-pointed straight bistoury in its original direction: this, however, the surgeon will seldom require to do, for, dilatation taking place principally during extraction, if he be patient and proceed a little more slowly he

will probably find the parts relax and will ultimately be successful without the necessity of enlarging the incision. Enlargement of the original wound may be done with the bistoury guided into the neck of the bladder by the calculus as it is held in the grasp of the forceps, or, with the object of greater accuracy, the forceps having dropped the stone and being withdrawn, the finger may be introduced to serve as a director for the knife in extending the incision. As this proceeding is attended with possible danger from proximity of the knife to the periphery of the prostate, it should only be resorted to when, as above stated, the incision has been made of unusually small size, and when from other circumstances the necessity for it has, after careful consideration, become undoubted; and it must be conducted in so cautious a manner as will lead to a definite and only slight extension of the incision in the prostate without endangering the capsule.

On the other hand, should the difficulty arise from the *large size* of the calculus, an endeavour should be made to crush it with the forceps already holding it; but if this be found impossible, and it be thought that bilateral section of the prostate will give sufficient room, incision of the right side of the gland should be practised; but if too bulky for this, it will be proper in most cases to crush it before extraction with a special

Difficulty from large
size of stone.

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crushing forceps. Exceptions to this are mentioned at page 181, when the recto-vesical method will be a safer operation.

Difficulty from spasm
of the bladder.

The same care and caution, which are required in *seizing* the calculus when spasm of the bladder is present, are also needed in an equal degree during the efforts made to *extract* it, and Thompson thinks that it is sometimes an advantage to pass a well-curved scoop between the bladder and stone to help the forceps in dislodging it.

Difficulty from
resisting fibres of
transversus perinei
muscle.

After the stone has been brought down below the prostate, its further progress may be impeded by uncut fibres of the transversus perinei muscle: if it be found impossible to overcome this obstacle by pressure with the finger, the resisting fibres should be notched with a probe-pointed bistoury.

Scoop, when needed,
and mode of using it.

Whenever, on attempting to extract with the forceps, the calculus repeatedly slips out of their grasp, a scoop should be passed up by the side and over the end of them to prevent slipping, and aid in making traction; or, the forceps being relinquished, an endeavour should be made to extract with the scoop alone. The best way of using the latter is as follows:—The scoop, together with the left forefinger, is introduced into the bladder, and the calculus being felt with the finger, the instrument is passed steadily on underneath the stone to its further extremity, the bulb of the finger being then placed on the upper

surface of the stone and its tip on the end of the scoop (the calculus being thus held as with a pair of forceps), the whole, namely, scoop, stone and finger, are drawn together out of the bladder and through the wound.

After extraction of the calculus, it should be Multiple stone. examined for facets—points rubbed smooth by contact with other stones; but as these (facets) are not always present, the operator should make it a rule to introduce his left forefinger into the bladder to ascertain the presence or otherwise of another stone. For this purpose, if pressure be made at the same time downwards on the hypogastrium, and if the perineum be not deep, the left forefinger will usually be long enough; but if not, a searcher must be employed. Should other calculi be detected, they can generally be extracted without trouble, the scoop being the most convenient instrument for removing numerous little stones. If there should be great difficulty and delay from the calculi being grasped by the rugæ of the bladder or from other cause, it will be prudent, lest the bladder should be injured, not to continue further efforts, but to defer them until the second or third day, when suppuration will have become established, care being taken in the mean time to free the wound if a stone should fall over its mouth and interfere with the free escape of the urine.

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Accidental fracture
of the calculus.

Accidental fracture of the calculus can generally be avoided, if the operator, having by sounding and by examination of the urine gained a previous knowledge that he has to deal with a fusible or other soft form of stone, avoids much pressure upon it with the forceps as he is drawing it through the neck of the bladder and prostrate: if, nevertheless, the accident should occur, he must relieve the patient of the fragments as he would of a multiple stone, though with greater caution, lest the angular pieces should wound the parts during extraction. Oftener, however, than in multiple calculi the surgeon will be unable to complete the extraction of all the calculous matter from the bladder at the time of the operation, for the stone may be crushed into numerous small fragments, and the frequent introduction of the forceps and scoop thus rendered necessary may excite such irritation and violent contraction of the organ that to persevere would be likely to end in inflammation of its mucous membrane. In this complication, having removed the larger fragments with the forceps and scoop, he must wash out the remainder with tepid-water injections repeated daily until the whole are expelled. The first injection should be given before the patient is removed from the table; on that occasion, if no better instrument is at hand, the surgeon will find a common enema syringe of a

size proportioned to the age of the patient a convenient one, its nozzle being guided into the neck of the bladder along the forefinger, and the water injected without undue force. Somewhat raising the trunk of the patient previously to syringing will facilitate the escape of the fragments. Subsequent injections should be administered, as recommended by Sir B. Brodie, whose directions are given in Chapter VIII. In all these cases, as well as in those of multiple stone, even though complete extraction is believed to have been accomplished, the surgeon should sound the patient after the lapse of a few days in order to satisfy himself that no calculous matter remains behind.

In favorable cases the after treatment is little After treatment. more than expectant. When the operation has been a prolonged one, the patient (especially if a child) is liable to be found suffering from shock or State of shock. collapse, and in this case the surgeon must at once administer the remedies useful for the relief of such a state.

The patient being left on the operation-table and kept in a horizontal position, his body must be enveloped in warm blankets, and bottles of hot water applied to the extremities, while a free access of air is provided for the face by fanning, &c.; liquor ammoniæ must be applied to and rubbed over the mouth and nostrils, and as soon

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as he can swallow, this medicine (liquor ammoniæ) should be given in full doses at short intervals with hot brandy and water or other stimulants. The surgeon must not leave the case until reaction is established.

Patient to be placed
on left side.

Meanwhile the patient should be unbound and placed on his left side, as this will have the effect of keeping the cut surfaces of the wound in apposition and prevent bleeding from them.

Removal to bed.

When oozing from the incisions has subsided, and in case of shock after reaction has taken place, a bed having been brought alongside the operating-table, and the wound and perineum of the patient carefully supported, he should be removed and placed on his back on the bed. One or more pillows must then be put under the shoulders to raise the upper part of the body, and so favour the discharge of urine by sloping the track of the wound; other pillows must support the knees; a large square of Mackintosh cloth should previously have been placed on the bed and covered with a folded sheet so arranged that it can be changed, or a dry portion of it drawn under the body of the patient, as often as it becomes saturated with urine. For the first forty-eight hours it is well that the patient should remain on his back, but after the lapse of that time he may, with the object of facilitating the exit of discharges, be placed on his right or left side night

and morning for a couple of hours, alternating the sides each time. This change of position is particularly useful also for another reason in Bed sores. elderly and weakly patients, namely, as a means of preventing bed sores.

Not to refer to this subject again, I will here mention that the skin of the back, hips, and buttocks of persons, who are liable to such sores, should be washed occasionally with brandy and water or astringent lotions to harden it, and then covered with a layer of simple ointment to defend it from the contact of the urine. A soft pad must also be arranged under the buttocks; or, what is still better, the mattress should be cut away under that part, the space being filled up with soft pads only. The scrotum, in such cases, ought to be suspended to prevent its becoming moistened with urine.

After the patient has been removed to bed, a Quantity of urine to be observed. vessel should be placed beneath the wound for the reception of the urine, and the quantity passed must be observed; and if after five or six hours have elapsed very little or none has collected, the surgeon should insert his finger into the bladder to ascertain that the passage through the wound is free.

No tube should be inserted into the bladder unless hæmorrhage comes on. Primary hæmorrhage is not of uncommon occurrence, and may Tube not to be used except in case of hæmorrhage.

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happen either at the time of the operation or during the first two or three hours afterwards, though the red-coloured urine which is always at first passed must not be mistaken for it. The urine may be distinguished by coming away in gushes and remaining fluid; while the blood is constantly dripping from the wound, and will be seen coagulated at the bottom of the vessel into which it is received. It is proper that the surgeon should stay with the patient for half an hour, and within easy call for several hours, after the operation, in case hæmorrhage should come on, especially as the liability to it is greatest in just those cases in which the effects would be very serious, namely, in old men, in whom the prostatic plexus of veins is enlarged, a large loss of blood being often followed by low inflammatory diseases from which such patients seldom recover.

After effect of
hæmorrhage
dangerous.

Internal bleeding.

It must not be forgotten that hæmorrhage may take place either soon after the operation or at a later period without showing itself externally by the wound, and, besides its own peculiar bad results, may interfere with the free escape of urine from the wound, or cause complete retention. Internal bleeding may be suspected if the patient becomes pale, cold, and faint; and his bladder distended (from blood flowing into it and coagulating there) along with a feeling of dysuria and complete retention, or a draining of blood from the urethra only,

none coming from the wound. To relieve this state, the finger must at once be gently introduced through the wound into the bladder, to open out the passage and clear away clots ; but should the vesical cavity, notwithstanding this, remain much distended with coagulated blood, it must be washed out with repeated gentle syringings, and, if the wound cannot be otherwise kept patent for the exit of the urine, the tube must be inserted. In all cases, but more particularly in this complication, the urine should frequently be inspected, as until it becomes abundant, clear, and of natural colour, the liability to hæmorrhage cannot be considered to have ceased, nor the proper action of the kidneys to be going on.

Urine to be frequently examined.

The subject of hæmorrhage is fully treated of in Chapter XII.

No opium should be given after the operation, unless there is great restlessness from pain or nervousness, for the after effects of a sedative are often more hurtful than disturbed rest. When needed, a dose internally may be given, or it may be administered in the form of a suppository of opium or of morphia.

Sedatives.

An aperient will nearly always be required, but not until after the lapse of three or four days, and then in many cases an enema of castor oil will be sufficient. To strong and plethoric men, however, it is sometimes advisable to give a dose of

Aperient.

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oil as early as the second day. On a few occasions, when deferred too long, the wound has remained quite inactive, with a surface looking like that of raw meat, until after the administration of the aperient.

Diet.

It is necessary to remember that very old people need nutritious diet at an earlier period than younger persons. The patient must be provided with a good supply of well-made barley-water, linseed tea, or gum-water. The diet for the first three or four days must be unstimulating, consisting of milk with farinaceous substances, and, in cases of debility, animal broths. Under exceptional circumstances, however, even wine and brandy may be required. Until the bowels act, or until suppuration is established in the wound, no solid food should be given to the patient unless he has a longing for it, when it may not always be thought well to withhold it; indeed, it has occasionally been found useful, when the patient's powers have appeared to be flagging during the course of the after treatment, to humour, within certain limits, his fancies in regard to diet and stimulants. While the diet after lithotomy must be supporting, it is very necessary that it should be given with judgment, as most of the patients have weakened digestions and damaged kidneys, which unfit them for assi-

milating an excessive and ill-regulated amount of food.

During the first few days, inflammatory swell- The wound.
ing is apt to supervene in the wound, blocking up the passage through it, and causing the urine to pass a few times entirely by the urethra : until this stage has gone by, if there is no tendency to hæmorrhage, a good application to the wound is a bread and water poultice retained by means of a **T** bandage ; but when the inflammatory action has subsided, all the urine again passing away by the wound, water-dressing will be better. About the tenth day the urine commences to come away partly by the urethra (at which time it is not unusual for the patient to feel a slight rigor due to sympathetic irritation), and in favorable cases the wound closes about the commencement of the fourth week, the whole urine then issuing from the natural passage ; until which time it is advisable to keep the patient in bed, as premature exertion is apt to be followed by some amount of permanent incontinence of urine. Healing of the wound is complete in a month or five weeks, though it occasionally happens that a little aperture remains unclosed for six weeks or more, a drop of urine coming away from time to time.

Healing by the first intention rarely takes Healing by the first intention.
place, nor according to Liston, is it a desirable

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occurrence, as it may conduce to infiltration of urine.

Inflamed and sloughy wound.

Now and then, within the first forty-eight hours, the wound becomes much inflamed, sometimes erysipelatous, when, if there is a tendency to prostration, gently supporting measures will be called for ; and at a later period, when the wound is in a sloughy condition, indicating an exhausted and low state of the general system, nourishing food with plenty of stimulants must be given at short intervals, while stimulating applications, such as resin ointment, tincture of benzoin, &c., are applied three or four times a day to the wound. It must not be overlooked that the unhealthy aspect of the wound may be a result of extravescicle cellulitis or some other internal disease which has been developed.

Indolent wound.

When the wound falls into an indolent state, the application of lunar caustic to the bottom and sides of it is very beneficial by stimulating the healing process. A favorable effect on this condition of wound is also produced if the coming away again of the urine through the natural passage is expedited by the occasional introduction of a catheter or bougie into the bladder, and leaving it there for a short time.

Fistula in perineo.

Fistula in the perineum is rare after lithotomy. It may be the sequel of an erysipelatous and sloughy wound, or may depend upon the deposit

of phosphatic matter on the surfaces of the wound, or the persistent discharge of it through the wound : at other times it may result from the urethra being the seat of old stricture or of recent swelling. It is a very difficult condition to heal, and requires that the treatment should be conducted with much care in the way recommended by Thompson ; stricture, when it exists, having been dilated and phosphatic matter having first been removed from the fistulous track by appropriate measures :—"The whole internal surface of the fistula should be lightly touched with the actual cautery in the form of a heated wire, or with the galvanic cautery, or with a probe coated with nitrate of silver." During the period in which caustics are being applied, he says that the patient "should withdraw all his water on every occasion for three or four weeks by catheter, provided he can accomplish it easily, so as to prevent any flow through the fistulous channel." Dr. Gross recommends that the catheter should be constantly retained in the urethra, and that the cauterizing with nitrate of silver should take place every fourth or fifth day, the patient during the whole time of treatment being confined to his bed lying on his back with the nates elevated. He says : "When the track is unusually small or the perincum uncommonly thin, relief may sometimes be afforded by the occasional introduc-

tion of a heated probe. . . . In intractable cases it may be necessary to incise the parts and pare the edges of the wound."

Since writing the above, Sir H. Thompson has kindly lent me his excellent 'Clinical Lectures on Diseases of the Urinary Organs,' and I find there such important hints for the treatment of urinary fistula that I will quote them in detail, merely referring my readers to Chapter XX on 'Urethral Calculus,' for plates of the urethroplastic operation, which, though not exactly applicable to the operation described below, may be useful in enabling them more easily to understand it:—"You first teach the man to pass a No. 7 or 8 gum-catheter himself—an easy matter enough. He then agrees to pass it every time he requires micturition, night and day. On no occasion is he to permit the urine to flow spontaneously—say during five or six weeks—not even when he goes to stool; and this is avoided by always using the catheter immediately before."

"Most commonly, however, if the soft parts have been largely destroyed, some plastic operation is required for the cure." In a man with an opening between the angle of the penis and the scrotum, "showing at least a third of an inch of the catheter, the whole of the floor of the urethra having sloughed away . . . what

was done was to pare the edges all round, then to get a flap of skin from the scrotum below, which was brought up to cover in completely the wound, the margins being carefully attached by a number of little sutures." A catheter was not tied in, the secret of success being, he states, as follows : — "A week or two before the operation I made the patient learn to pass the catheter habitually, so as to draw off every drop of urine ; and finding him thoroughly expert at it, I performed the operation, and for a month he never allowed a single drop of water to pass otherwise than by the catheter. Had I tied the catheter in, it would not have been sufficient because the water, as I told you, always finds its way by the side sooner or later."

If the surface of the wound should become coated with phosphates, dilute nitric acid lotion will be the best dressing, and in most cases the local application should be aided by the internal exhibition of the remedy. A much more serious state than this is mentioned by Mr Coulson :— "Phosphatic deposits are sometimes reproduced in great quantity after the operation ; when this occurs, we must leave the wound open, wash out the bladder frequently with tepid injections, and combat the inflammatory state of the bladder, on which the tendency to phosphatic secretion depends." Though this condition is seldom met

Wound coated with phosphates.

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with except after lithotrity, when severe irritation of the bladder has been allowed to continue; it may also follow lithotomy, if the same cause be present.

Spasms of the
abdomen.

Severe spasmodic pain in the abdomen which may attack the patient during the first few days after the operation, either with or without retention of urine, is greatly benefited by a hot hip bath.

Retention of urine.

It sometimes requires care to avoid overlooking the retention, especially when it is not quite complete, some urine coming away through the wound, and a little perhaps passing by the urethra. In this state the distress goes on increasing, the abdomen becoming more swelled and tender, until the finger has been introduced into the wound to open out the passage of the urine, or some other treatment has been applied. This will differ according as the retention has been caused by inflammatory swelling of the whole length of the wound; by spasm of the neck of the bladder or urethra, or, as more frequently happens, by closure of the wound or distension of the bladder with coagulated blood. Coulson recommends the catheter to be used for the relief of spasmodic retention, and I think it might be employed with benefit in that depending on sub-inflammatory engorgement of the wound; but when resulting from the presence of coagula,

these must be cleared away from the wound by the finger, and washed out of the bladder by injections of cold water, and then means must be taken for preventing further hæmorrhage, and the wound kept open by the insertion of a tube. In the forms of retention not dependent on hæmorrhage, the warm bath and warm fomentations should be used, and in the spasmodic form opiates administered.

Some amount of tenderness on pressure follows Abdominal tenderness on most operations of lithotomy, but soon passes away under the influence of fomentations and poultices, with the addition of a dose of oil if there be nausea, with swelling of the abdomen from constipation. When, however, the tenderness is acute and attended with fever, it will require to be treated by constant fomentations and poultices, with the internal administration of Dover's and grey powders, and on a few occasions I have applied a small number of leeches with benefit.

The symptoms if indicating peritonitis generally appear in twenty-four, or not later than forty-eight, hours after the operation, with, in the primary form, tenderness on pressure of the abdomen; gradually increasing swelling of that part; small wiry pulse and cadaverous appearance. For this form, Coulson directed "antiphlogistic treatment with calomel and opium, and Peritonitis.

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frequent fomentations to the abdomen;" and Syme, "free depletion, both local and general, warm fomentations, and the warm bath." The general depletion recommended by the latter author, I think, will seldom or never be found safe for the already weakened system of a calculous patient. A form of peritonitis rather oftener met with than the above is one which is secondary to cystitis, and is insidious in its symptoms and progress. A description of this, with its treatment, will be found in Chapter XIII.

Intermittent fever.

During convalescence, in India, intermittent fever is apt to show itself in patients having a malarious taint. As long as the irritation of the bladder continues, this poison may remain latent; but the irritation having ceased, and the system being weakened by loss of blood and the shock of the operation, the malarial poison lurking in the blood shows itself by daily fever preceded by rigor.

Diarrhœa.

Diarrhœa is a troublesome complication. In many patients this is no doubt an effort of nature to supplement the defective action of the kidneys, and therefore should not always be stopped by powerful astringents. The motions I have, on several occasions, observed to be of a dark green colour, containing slime and much undigested food, and I have found that this state cannot be relieved without great care in dieting. One

article of food, which appears to be especially useful on account of its nourishing and astringent properties, consists of ground rice and milk boiled smooth, called in India by the name of *kheer*, and another which I have occasionally given with benefit is rice with the curds of milk, also astringent. It is impossible in most cases to say beforehand what kind of medicine will be successful; Acid. Sulphuric. dil. I have found the most generally useful, but all the astringents in turn, and some of the sedatives and tonics, may require to be tried, such as small doses of opiates, catechu, lead and opium enemas, Pulv. Cretæ co. c. Opio, Dover's powder, wine of iron, Acid. Nit. dil., decoct. of cinchona, port wine, &c.

Orchitis, usually coming on about the end of Orchitis. the second or the beginning of the third week, is an occasional consequence of the injury inflicted upon the ejaculatory ducts, and generally involves one organ only. The treatment should be the same as for ordinary orchitis in a weakened subject.

Flatulent distension, if very troublesome during Flatulent distension of abdomen. convalescence, may be treated by turpentine stupes or by an enema, spoken highly of by Mr Druitt, consisting of one drachm of the essential oil of rue or peppermint thoroughly diffused through a pint of gruel or soap and water.

Old and weakly patients should be kept under

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Old and weakly
patients.

observation and in good hygienic circumstances for a period of not less than four weeks after the operation, for, if discharged from hospital sooner and lost sight of, exposure to cold and injudicious diet may set up kidney irritation.

CHAPTER VIII

QUOTATIONS FROM AUTHORITIES ON THE SEVERAL STEPS
OF THE LATERAL OPERATION, WITH OBSERVATIONS
BY AUTHOR

Sir H. Thompson says:—"If the bowels have been regularly and sufficiently moved in the natural manner, a purge is undesirable, as it only weakens the patient." An aperient ought not to be given to very debilitated patients; but to others I think it desirable, as the bowels may contain indigestible food (though the motions appear natural and sufficient), and it is necessary to allow them to remain quiescent for several days after the operation.

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Aperient to be given
before the operation
or not?

Samuel Cooper approved of injecting the bladder, but states that Sir A. Cooper disapproved of it. Samuel Cooper writes:—"The presence of urine in the bladder, it is conceived, may lessen the chance of the fundus of that organ being injured by the gorget. . . . The plan is disapproved by Sir A. Cooper, who says that when the urine collected gushes out, the bladder contracts and embraces the stone so closely that it is difficult to get hold of the foreign body with

Urine to be retained
or the bladder
injected before the
operation.

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the forceps.” Sir H. Thompson says :—“ It is sufficient to take the chance of the urine accumulating for an hour before the operation ; at all events any attempt to inject an irritable bladder is rarely of any service.” Spence mentions a case of difficulty caused by the neglect of the precaution of giving an injection before the operation. He says :—“ The bladder was contracted so as to render the use of the forceps difficult. . . . I believe that had I injected the bladder before the operation, the stone would have been seized and extracted with ease.” The opinions of

Author's observations. Sir A. Cooper and Spence are thus seen to be directly opposed to each other ; but experience has proved that the fears of the former were unfounded, and that the presence of fluid in the bladder at the time of the operation is an advantage ; for the stone is often at once caught as it is brought towards the neck of the bladder by the gush of the fluid outwards on the introduction of the forceps ; and if not, the whole of the fluid seldom escapes so quickly as to leave the bladder empty and contracted during the manipulation of seizing the stone with the forceps. If, therefore, the bladder cannot be made to retain its urine, an injection should be given in all cases except those referred to at page 87.

The importance of this rule is mainly due to the fact above quoted, that the presence of fluid in

the bladder at the time of the operation lessens the chance of the fundus or the walls of the bladder beyond its neck being injured by the cutting instrument introduced into it; and on the contrary it will be readily conceived that the liability to this accident is increased when the bladder is empty and contracted around the stone, bringing the fundus and other parts of its walls into close proximity to the edge of the knife as it enters the neck of that organ. The presence of fluid in the bladder is especially useful when this viscus is situated at an unusual depth from the surface of the perineum, as is commonly the case in fat patients and those affected with enlarged prostate, for the bladder is thus brought down lower in the pelvis and within more easy reach of the knife, while the escape of fluid as soon as the neck of the bladder is incised is a safeguard against too deep an entrance of the knife into it.

A set of sounds must be present, and should include one with a short curve for exploring the bladder behind an enlarged middle lobe of the prostate; and one almost straight, to be used after the operation as a searcher for fragments of stone left in the bladder.

It is advisable to be provided with several sizes of staffs. With reference to the best form of these, Thompson says that staffs should be “as deeply

Instruments.
Sounds.

Staffs.

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and widely grooved as their size admits, consistently with maintaining their strength. The groove to be midway between the convex and the lateral aspects of the staff, to stop abruptly half an inch from the end, and not to extend so far up the handle as to permit the urine to escape." My opinion is that Thompson's staff with a curvature corresponding exactly to that of the neck of the urethra and prostate gland is the best form for operating with in all cases except in those of very large stone, when I prefer a staff grooved on its convex aspect, so as to facilitate the passage of the knife along it if incision of the right side of the prostate be thought necessary.

The operator ought to use the same scalpel both for the external and internal incisions, and reserve the probe-pointed knife for enlarging the wound when necessary, as, on changing the knife, a difficulty may be experienced in fixing the probe-pointed knife on the staff, in the exact part of the urethra already incised, without its being entangled in uncut mucous membrane. The common lithotomy scalpel is thus described by Thompson:—"A knife of which the blade and handle together measure (for an adult) about $7\frac{1}{2}$ inches long; of this the blade may be about 3 or $3\frac{1}{4}$ inches. The cutting edge should have a length of about 1 inch from the point." As stated by Spence, it must be "bevelled off at the

back near the point, so as to glide readily in contact with the groove of the staff."

"The blade and handle may measure together Probe-pointed knife. about 8 inches ; of this the blade may be about $3\frac{1}{2}$ inches. A large probe point should terminate the blade. The cutting edge should extend to about $1\frac{1}{4}$ inch from the point."—*Sir H. Thompson.*

The lithotomist must provide himself with Forceps. straight and curved forceps of various lengths and shapes. Thompson insists on the desirability of the forceps being of good length, with their ends not quite meeting ; the latter precaution is recommended lest they should pinch the mucous membrane of the bladder on failing to grasp the calculus. On this subject he writes :—"It is desirable to have the blades of good length, so that the angle produced by opening them is acute rather than the reverse ; a better form of wedge is then presented to the orifice through which the instrument and the stone have to pass. . . . If lined with very thin canvas or kid leather they afford a surer hold, and avoid any crushing of the stone. The extremities of the blades must not meet, an interval of about one eighth of an inch should exist between them when the instrument is closed." The blades as generally made are not lined, as above recommended, but dentated ; the teeth, however, should not be very long, or they are apt to break the calculus.

It is necessary to have at hand tubes of sizes, varying according to the depth of the perineum, for insertion into the bladder when hæmorrhage threatens, or has already taken place. The practice of using the tube in ordinary cases has been long discontinued. Coulson recommends it in the undermentioned conditions ; he says :—" It assists in preventing the extravasation of urine into the cellular tissue of the pelvis, in cases when the internal incision may have been carried beyond the limits of the prostate." This, however, in my opinion, ought never to be the case, but should it occur, the beneficial effect of inserting the tube into the bladder is doubtful, for a portion of the urine will always escape by the side of it, and become extravasated into the cellular tissue. A more successful practice than this is to favour the ready exit of the urine from the bladder by placing the patient in a semi-sitting position for several days, and by being careful to keep the wound clear of coagula of blood.

The most useful size of tube for adults is four or five inches in length and half an inch in diameter ; but for deep perineum it will require to be six or seven inches long. They are generally made of gum-elastic ; but in India, on account of their greater cleanliness and cheapness, I preferred to use iron tubes covered with lint. The tube has usually an open end, and may also

with advantage have side openings as well; and the end, especially if an iron tube be used, should be smooth and quite blunt.

One word about the introduction of these tubes into the bladder may not be amiss:—When covered with lint or used in the form of the “*canule à chemise*,” the easy passage upwards of the tube is prevented by the folds of lint or cloth sticking to the sides of the wound. The only safe mode is to pass the tube up the wound by a gentle twisting or wriggling motion rather than by force, and to guide it into the neck of the bladder by the index finger, just as is done with the forceps; unless thus carefully introduced, it may pass between the bladder and rectum, instead of entering the neck of the bladder.

For use in cases of deep perineum I am disposed to think it safer to have the end of the tube closed and of a conical shape, the openings being placed at either side, as this form is less liable to catch in the wound at the time of being passed than when the end is open.

Thompson prefers Pritchard’s anklets, but the Lithotomy garters. garters are in general use, and are best made of strong worsted, eight feet in length for adults. One of these is to be applied on either side by doubling it in the middle, and drawing the two ends through this; the patient’s wrist is fixed in the loop thus formed, the hand is made to clasp

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the outer edge of the foot, the fingers lying transversely below the sole with the thumb across the dorsum; the free ends of the garters are now wound in the figure of eight, one over the dorsum, the other under the sole of the foot, and round the wrist, ankle, hand and foot, several times, and are secured by being tied together.

Tenaculum.

A tenaculum is sometimes required for the securing of a vessel too deep-seated to be taken up by the common artery forceps. The most useful form is that described by Dr Keith:—"The hook unites with the handle by a screw, and can be separated from it, for the purpose of leaving it in the wound beneath a deep-seated vessel after tying round it, when the ligature cannot be secured otherwise."

Blunt gorget.

Thompson allows this to be occasionally used; he says:—"A blunt gorget about five and a half inches long exclusive of the handle, curved from side to side, and terminated by a probe point, to run in the staff. This is a useful instrument where the perineum is so deep, or the prostate so large, that the finger cannot reach the bladder, as occasionally but rarely happens."

Introduction of the
staff.

Unexpected difficulties are sometimes met with in the introduction of the staff.

Fergusson says:—"The staff is not in every instance introduced so readily as may be imagined."

Poland, in his article on lithotomy in Holmes's Surgery, writes :—" With regard to the passing of the staff, great attention and care must be paid to its use in children, as a false passage is readily made, so that the instrument enters the pelvis below the bladder instead of passing into it ; and in some rare instances unusual force has separated the urethra from the prostate."

The same abnormal conditions of the urethra which interfere with the passage of the sound will also prevent the easy introduction of the staff; the latter seems even more liable than the former to catch in obstructions, and to make a false passage if force be used in passing it. If, after a trial not exceeding ten minutes in duration, conducted as described at page 46, the instrument cannot be passed, the operation must be deferred for the present. On trying another day, the obstruction will often be found to have disappeared, should it have arisen from a small stone in the prostate causing irregularity of the urethra, or from a stone in the bladder lying in such a position as to obstruct the entrance into its neck, the stones having altered their position in the interim.

Sir H. Thompson says, if the stone "cannot be felt with the staff, a sound should be introduced. . . . It may be necessary, in order to discover it, to inject a little warm water,

Sounding with the staff.

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particularly if the bladder has emptied itself during the sounding. If, after a fair search, the stone is neither heard nor felt, no operation can take place, and the search must be resumed on another day. . . . But it is very desirable, and, in most cases it is possible, to strike the stone with the *staff itself, upon which the patient is to be cut*. Because, supposing the stone to be struck with the ordinary sound, and some difficulty is experienced in passing the staff subsequently, it is possible the operator has made a false passage, and unwittingly passed the instrument out of the urethra altogether. . . . An experienced surgeon knows whether the staff is in the bladder, without feeling actual contact with the stone, by the degree of mobility possessed by an instrument rightly passed, strongly contrasted with its fixed position when passed out of the urethra." In the young, however, "a staff passed into the cellular interval existing between the rectum and bladder has often a good deal of mobility, and thus is believed to be in the vesical cavity."

The rule that the presence of a stone in the bladder must be ascertained at the time of the operation ought *never* to be departed from, because it is just possible that since the previous sounding the calculus may have been forced by violent contractions of the bladder into a cyst,

and so rendered unsuitable for operation, unless it should again become disengaged. Almost equally binding also is the rule that the stone be struck by the *staff* itself before cutting into the bladder, and when this is not readily done, the search for it should be made in the way recommended at page 39, in cases of similar difficulty in sounding.

The importance of the above-mentioned rules False passage. is principally due to the readiness with which, in children, the staff, instead of passing into the bladder, enters the cellular interval below it. The false passage, which thus results, is generally due to the carelessness or inexperience of the surgeon, in adopting the reprehensible practice of passing the staff after the patient is tied up, or in endeavouring to introduce one which is too large to glide readily along the urethra without the use of force. The diagnosis of this accident is often obscure in young cases, on account of the staff having a good deal of mobility when passed into the cellular interval between the bladder and rectum; and this uncertainty is increased if the stone lie so close to the mouth of the bladder as to be struck by the side of the staff after it has passed into the false passage.

Another cause of possible difficulty in the discrimination of this state is mentioned by Dr H. M. Humphry, who says the surgeon may feel the

calculus through the thin covering afforded by the coats of the bladder and, deceived by it, may pass the forceps into the cavity of the false passage and endeavour to make extraction. When there is reason to suspect that this accident has occurred, the position and direction of the staff should be examined by the finger through the rectum; and if the instrument be felt too superficially, from being covered with less tissue than usual; if the direction of it deviate from the middle line of the body; if the *point* of it cannot be made to strike the stone, and, in thin persons, if the abdominal walls cannot be elevated by its point when the handle is depressed, then suspicion becomes almost certainty that the staff has passed into a false passage, and it must at once be withdrawn from the urethra.

In cases where the least suspicion exists of false passage, I would add to the rule of distinctly hearing and feeling the stone before operating, that unless it can be struck with the *point* of the staff, and felt as an isolated and movable body in the bladder, no operation should take place.

Should the operator have incised up to the neck of the bladder before detecting his error, he must at once withdraw the point of the staff from the false passage, and, guided by his forefinger, pass it into the bladder (the unopened lips of which

will appear softer and more regular than the thin undefined margin of the false passage), and having reintroduced the knife, incise the neck of the bladder and extract the stone; and, during the after-treatment, keep the patient in a semi-sitting position, in order to favour the ready exit of the urine from the bladder.

Though most operators entrust the holding of the staff to an assistant, I prefer, for the reasons stated below, to hold it in my own left hand while making the *internal* incision.

Thompson and Coulson both give the staff into the charge of an assistant.

Poland, almost in the identical words used by Liston on this subject in his 'Surgery,' says:—"The surgeon's left hand is thus left at liberty throughout the whole operation to guide the knife, guard important parts," &c.

On the other hand, Skey says it is preferable "to take the handle of the staff in the left hand. . . . We may thus avail ourselves of the natural harmony of action always existing between the two hands of the same person."

In connection with this subject, Bryant writes:—"There is good reason to believe that many of the mishaps connected with the operation are due to the sound having been partially withdrawn from the bladder by one who is perhaps stooping forward trying to get a sight of the operation, and

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at the same time unconsciously altering the position of the staff."

Author's observations.

In this opinion of Bryant's I fully concur, and am of opinion that no circumstance is so likely to cause embarrassment and danger during the operation as a bad staff-holder. By carelessly inclining the handle towards the walls of the abdomen and pressing the staff downwards, he may cause it either to be withdrawn from the bladder, or so closely to approximate the bladder to the rectum that the latter may be wounded during the internal incision; this malposition of the staff may also lead to the neck of the bladder being divided to a dangerous extent posteriorly. Lastly, he may push it deeply into the bladder, and so cause a freer incision to be made into that viscus than is safe. I therefore recommend the operator to hold the staff himself when making the *internal* incision, and he will then by the harmony of action between his two hands be able to avoid these dangers. He will also find it easier to prevent the point of the knife from slipping out of the groove of the staff, or if it should catch in a notch in the groove, he can alter the relation of the knife to the staff in any way required to enable it to pass on, either by slightly raising the handle of it, or by giving the blade a wriggling motion, or by slightly drawing back its point and then passing it forward again.

On the other hand, the only advantage of giving the staff into the charge of an assistant is, that the left forefinger of the operator is then at liberty to guard the rectum from injury. This is only required when that part is enlarged from disease and overlapping the prostate—a state, however, of unfrequent occurrence.

I will here give the views of authors on certain External incision. points connected with this incision, which are not treated of in detail in Chapter VII.

The external incision divides successively the Parts to be divided. skin, the common superficial fascia, containing an unusual quantity of fatty tissue, the superficial perineal fascia (these two fasciæ cannot be distinguished as separate layers without careful dissection), the external hæmorrhoidal arterial twigs, the transverse muscle of the perineum, the transverse perineal branches, the posterior fibres of the accelerator urinæ muscle, a part of the deep perineal fascia or triangular ligament where the urethra passes through it, the anterior fibres of levator ani muscle, and lastly, the membranous portion of the urethra with the muscular fibres around it.

In the words of Thompson these are:—"In Parts to be avoided. front, the artery of the bulb and the bulb itself. In the median line, the rectum. On the outer side, the pudic artery; which, however, could only be endangered by the most reckless incisions."

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Manner of making
the incision.

Samuel Cooper says:—"The incision in the integument is to be at least 3 inches in length in the adult subject."

"It is commenced in adults from 12 to 15, in young people from 9 to 12, in boys from 6 to 7, and in children, 5 lines above the anus, on the left side of the raphé."—Chelius.

"The point" (of the knife) "should be entered about a line's breadth left of the raphé, pushed through the skin, and carried by a kind of sawing motion down the left side of the perineum, about an inch beyond the anus, the middle of the incision being at equal distances from the latter part and the tuberosity."—Fergusson.

"It must not be overlooked that the lower the incision is placed the more danger there is of wounding the rectum; and especially so if the operator overlook the necessity for commencing at a little greater distance from the raphé, when he enters the knife at $1\frac{1}{4}$ inch instead of $1\frac{3}{4}$ inch above the anus."—Thompson.

Author's observations.

In the above quotations are included the most important points for the proper making of the external incision, viz. to make it not less than 3 inches in length; to enter the knife superficially one line's breadth only from the raphé, and not more than $1\frac{1}{4}$ inch above the anus; and to carry

the incision midway between the tuberosity of the ischium and the anus well back to an inch beyond the latter part. The advantages to be derived from attending to these directions are the following :—

A free incision, commencing low and extending well back, facilitates the remaining steps of the operation, and by providing a direct outlet prevents any future lodgment and effusion of urine into the cellular tissue between the prostate and rectum ; a low incision also avoids the bulb and the artery of the bulb, while it does not endanger the rectum, if the precaution of cutting through the integument alone at the fore part of the incision be used, instead of following the very reprehensible practice of plunging the knife freely into the perineum, as recommended by some authors, and as described by one of them, who says he “plunged” (the knife) “in at once, the first stroke to the depth of at least one inch.” Fergusson’s rule of commencing the incision at a line’s breadth from the left of the raphé is simpler than that of varying the distance from the raphé, according to whether the incision is commenced high or low. His practice should therefore be adhered to, care being taken to avoid the bulb of the urethra and the rectum by pushing them aside, and by dividing the skin and superficial fascia only of the front part of

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the incision under which these organs lie. Fergusson's suggestion also, that the middle of the incision should lie at an equal distance from the anus and the tuberosity of the ischium, is better than that of those surgeons who incline it rather outside the middle line towards the ischium. By the practice of the latter the tendency to hæmorrhage is increased, for even if they do not endanger the internal pudic, they cut its branches where they are of a larger size than at a greater distance from their origin, and oftener wound the superficial perineal branch than those do who, following Fergusson's advice, make their incision along a line which is generally to the inner side of this vessel, and consequently only cut the small transverse perineal branches and the inferior hæmorrhoidal twigs.

Cutting into the
membranous portion
of the urethra.

Crichton, of Dundee, a most successful operator, says :—

“I have witnessed much unpleasant cutting, in the endeavour of the operator to get the knife inserted into the groove of the staff, perhaps from his thoughts being occupied in what those present might be thinking of him, or from want of clearness of conception in his mind in regard to the situation of the parts to be divided; and oftener than once I have been requested to assist in accomplishing it.”

“The blade should be made to perforate the

membranous portion of the urethra about 3 lines in front of the prostate.”—Fergusson.

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Best point to penetrate.

“The best point of the urethra to open is perhaps as close to the anterior part of the prostate as possible,” for “from the way in which the bulb overlaps and conceals the under surface” of the membranous portion, “unless the knife be made to enter the urethra close in front of the prostate, the bulb must almost of necessity be wounded.”—Samuel Cooper.

“The forefinger of the left hand” gains “the groove of the staff behind the bulb, and just anterior to the resisting deep fascia.”—‘Holmes’ Surgery.”

Guide to position of apex of prostate.

Butcher, of Dublin, who has devoted special attention to lithotomy in children, writes that, in a child one year and four months old, “the urethra was cautiously opened a few lines behind the anterior angle of the wound.” In a boy aged 7 he says:—“The point of the knife was next struck into the groove of the staff about 3 lines behind the spot where it was first laid on” (in making the external incision), “the point of the instrument being gently moved from side to side to confirm its safe position in the staff.” Again he writes:—“The knife should enter and strike the staff at the commencement of the membranous portion of the urethra I cannot lay too much stress on the necessity of

Opening of urethra in children.

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freely opening the entire of the membranous portion of the urethra by the one and continuous stroke of the knife. This should be the surgeon's aim ; for if the knife be introduced again and again, with the intention of clearing the staff, the difficulties of completing the operation are greatly increased ; the urethra is wounded and notched in several parts, shreds of it may hang into the groove of the staff, and impediments so offered to the blunt-pointed knife, so that it cannot travel freely or with security to the division of the prostate and neck of the bladder. But graver consequences may still follow this imperfect division of the membranous portion of the urethra. It may be so injured by repeated wounds that the remaining connecting tissues may fail to resist the efforts essential to the completion of the operation, and give way, and so the surgeon may thus be foiled in reaching the bladder."

Author's
suggestions.

My experience supports that of Crichton, as quoted above, that young operators not unfrequently bungle over this part of the operation. Crichton suggests that this may be due to want of clearness of conception in regard to the situation of the parts to be divided. To meet this difficulty, I would suggest that the operator should take the lower border of the subpubic arch as the landmark towards which to direct his

incisions, and should cut carefully and steadily onwards in that direction until he can feel the staff, where it lies between the subpubic arch and the resisting deep fascia in front of the prostate; remembering that in a fat patient the distance between the external surface and the membranous urethra is increased, which renders it necessary to make the incisions in a freer manner than in a spare patient: then inserting the nail of his left forefinger into the groove at this spot, which will be about 3 lines in front of the prostate, he should incise the membranous portion of the urethra to the extent of a few lines, and fix the point of his knife fairly in the groove of the staff.

By opening the urethra close to the apex of the prostate, the surgeon avoids the danger of wounding the bulb of the urethra, of which, in adults, without this precaution, there is considerable risk. In children, however, in whom the bulb is not much developed, it is better to follow Butcher's practice quoted above, and cut into the *anterior part* of the membranous portion of the urethra. This is preferable to penetrating the urethra more posteriorly as in adults; since on account of its superficial situation, it can be readily opened anteriorly by one clean incision instead of by repeated cuts, which might otherwise be necessary. This part of the operation in

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children is easily accomplished, and only requires, for its safe completion, that the point of the knife should be made to enter the groove of the staff a few lines behind the anterior angle of the external incision, and should then open the membranous portion of the urethra, as above directed.

Internal or deep
incision.

The internal incision is that part of the operation which requires for its safe and judicious performance the greatest amount of delicacy, combined with judgment.

Anatomy of the part
concerned.

It will simplify the consideration of this subject to recall clearly to mind, first of all, the anatomy of the parts in the adult through which this incision is made. According to Coulson:—"The distance from the skin of the perineum to the neck of the bladder varies from one inch and a half to three inches, or even more when the subject is extremely fat," the average being about two inches and a quarter. The prostate gland measures in the mesial line, from above downwards, 12 to 14 lines in the adult, with the longest axis of each lobe extending from the apex at the membranous part of the urethra obliquely downwards, outwards, and backwards, towards the base, giving, in the words of Spence, "a difference of 3 or 4 lines more than the mesial measurement; and this direction is also that in which the incision is least likely to injure the reflection of

the ileo-vesical fascia, as it runs lower down and parallel to the line of reflection.”

In the following paragraph, Coulson states that he is an advocate for moderate incisions, and explains what he means by such an incision. The question of limited or free incisions.

“I am . . . an advocate for moderate incisions followed by gentle dilatation during the extraction of the stone. . . . A moderate incision, according to my meaning, is one which does not pass through the whole depth of the prostate, but leaves a few lines of that body near its base, and the capsule undivided. A freer incision is one which divides the whole of the prostate; and an extremely free incision would be one involving also a portion of the neck of the bladder. Mr Samuel Cooper, in his dictionary, affirms that most lithotomists prefer a free internal incision—one which passes through the whole of the prostate and part of the neck of the bladder without touching that organ.”

Coulson continues:—“When the stone is more than 20 lines in diameter, the whole thickness of the prostate must be cut, or other methods employed; but for all calculi below 20 lines, Deschamps shows that an incision of 8 lines, or $\frac{3}{4}$ of an inch, is quite sufficient. This is exactly the opinion of the late Mr Liston. . . .

‘The internal incision (says Mr. Liston in his ‘Practical Surgery’) should certainly not extend

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beyond seven lines from the urethra outwards and downwards; the less that is cut the greater is the patient's safety.' With proper dilatation, according to Mr Liston, a stone of from 3 to nearly 5 inches in circumference in one direction, and from 4 to 6 in the largest, may be thus removed." Fergusson is also in favour of limited incisions. He says:—"I declare my preference to a limited incision, for I believe as implicitly in dilatation here as I do in the neck and mouth of the uterus in parturition, even though the latter is effected by nature, while the former is by force on the part of the surgeon." He states his belief "that in a large majority of cases the opening in the deep part of the perineum and neck of the bladder need not at first be larger than what the forefinger will stop," and says that he has "never experienced any remarkable difficulty in extracting stones weighing four ounces without the necessity of cutting beyond the prostate."

Direction of the line
of the incision
through prostate, &c.

When the stone is of moderate size, the best plan is, as Coulson directs, to make the external and internal incisions "as nearly as possible in the same plane; that is to say, the internal incision should look obliquely downwards and outwards in the same direction as the external wound;" but if the stone be large, and it be consequently necessary to make as free an inci-

sion through the prostate as can be done without exceeding the limits of safety, "it is necessary to recollect," as Thompson says, "that if the incision in the prostate be made in the same direction as that of the skin, the limits of the gland would be more easily exceeded. The line of safety through the prostate and neck of the bladder, whether we regard the distance of its enveloping capsule from the staff, or the situation of the seminal ducts, is a slightly oblique line, directed rather nearer to the horizontal than to the perpendicular." Such an internal incision would look towards the lower edge of the tuberosity of the ischium, and would therefore not be exactly parallel with the external one.

On this subject the latter author writes:—
"The knife is now carried steadily along the groove into the bladder, the operator being careful to remember that the depth of the incision in the prostate very much depends on the angle which the blade makes with the staff in that act. The hand, therefore, must not be lowered too much; if a small incision is required, the knife is to be maintained very nearly in a line with the extremity of the staff, so as to make an acute angle with it; the point being kept up only enough to insure its transit clearly and closely along the groove, which must not be quitted for an instant."

Angle the knife
should make in
passing along the
staff.

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Incision of ring of elastic tissue at the neck of the bladder.

At the opening of the bladder, surrounded by the prostate gland, there is a ring of dense elastic tissue about 3 lines in breadth and depth, and it is the incision of this, allowing considerable dilatation of the gland, which enables us to extract by the left lateral operation calculi of larger dimensions than the usual incision of the prostate could be supposed to admit of.

Syme insists on the importance of incising the elastic tissue at the neck of the bladder:—"At the base of the prostate, where it joins the neck of the bladder, there is a dense texture forming a ring around the urethra; it is thickest immediately under the mucous membrane, whence it gradually tapers away. There can be no doubt that if this texture be torn the patient will die; if it be extensively lacerated death will probably occur in two days; and if the injury be of less extent, chronic inflammation will be set up about the neck of the bladder, leading with no less certainty to a fatal termination." This incision of the ring is easily accomplished; in fact, it is always sufficiently effected by the act of pushing the knife into the bladder along the groove of the staff.

Full condition of anæsthesia to be induced.

In muscular adults when struggling or in a condition of spasm, and who are not in a state of anæsthesia, Miller says:—"The operator must withdraw the knife; and keeping his finger in

the deep wound; he should wait patiently until the straining or spasm has ceased, establishing the full influence of chloroform."

Spence says:—"The real cause of such mis-
fortunes seems to me to be, either that the point
of the staff has slipped from the bladder, and so
misguided the knife, or that the knife has slipped
from the groove in taking the curve, and thus
when the operator passes up his finger, the loose
cellular tissue is broken up with the finger, and
he mistakes it for the cavity of the bladder, and
feeling the stone perhaps through the thin coats
of the bladder above, he makes futile attempts at
extraction."

Cause of accidents
while making the
internal incision.

I have made full extracts from authors on the
subject of the internal incision for the guidance
of the surgeon, as this is the part of the
operation in which difficulties most often occur
of his own making. The directions I have
given in Chapter VII will be found sufficient
in all cases of stone of moderate size, that is,
when not exceeding an inch and a quarter in its
mean diameter. When, however, the calculus
exceeds $1\frac{1}{2}$ inch in its mean diameter, or $4\frac{1}{2}$
inches in circumference, it becomes of a size
which will generally cause trouble in extraction;
but if more than 6 inches in mean circumference,
it can very seldom be extracted through the left
lobe of the prostate, the longest axis of which

Author's
suggestions.

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does not exceed $1\frac{1}{3}$ to $1\frac{1}{2}$ inches (unless bisection of the prostate be resorted to), without disorganising the parts through which it is withdrawn. In the appendix will be found a table which shows the diameter and circumference of 14 calculi, with the relation size bears to weight: the latter, the only point referred to by most authors, is of much less importance than that of size, in forming an opinion as to the fitness or otherwise of a patient for operation. The last entered is a good example of a stone of a size, which it is almost always impossible to extract without bisection of the prostate. The latter operation was found necessary in this case, the patient making a good recovery.

If the operator, having formed his diagnosis in the way recommended at page 44, thinks he has to deal with a calculus beyond a moderate size, but yet a suitable one for the left lateral operation, he should provide himself with a scalpel broad enough to make, in the act of pushing it along the groove of the staff, an incision of 7 to 9 lines through the prostate gland. In making this incision the guidance of the staff ought never to be left, for an error of a few lines only may extend it beyond the capsule of the prostate; and on account of the liability to this accident, I consider that the practice recommended by an eminent surgeon,

that "if the stone is supposed to be of considerable magnitude, the blade should, in withdrawing it, be carried a little out of the groove, so as to increase the incision of the prostate," however safe in the hands of that very expert operator, would be attended with much danger if followed by a less experienced one. Instead of running this risk, the best course to pursue, if the operator thinks that more room is wanted, is carefully to withdraw the knife first introduced, and then selecting one (a probe-pointed one if at hand) with a *broad* blade, to pass it along the staff through the incision already made in the left side of the prostate into the bladder; a second incision being, according to my experience, much safer than the division of the gland without the guidance of the staff. This practice is in accordance with that pursued by Sir B. Brodie, who used and recommended a probe-pointed knife, of which he says "the blade is broad enough to divide a considerable portion of the prostate as it enters the bladder without its being necessary to increase the size of the incision by cutting laterally afterwards."

While it is vitally important that the internal incision should be a moderate one only, yet it is of almost equal consequence that it should be made to such an extent through the prostate as

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to admit of dilatation without forcible laceration of the gland, and also that it should penetrate into the neck of the bladder, incising a few fibres of the ring of elastic tissue there situated. Unless these fibres are divided, sufficient dilatation of the neck of the bladder and adjoining portion of the prostate gland cannot be made to admit of the extraction of a large stone, without such contusion and tearing of the delicate cellular connections of those parts, as may lead to fatal injury from inflammation and disorganization; and it is here that a difficulty often occurs of the surgeon's own making, who does not run the knife along the staff far enough to reach the bladder and notch the fibres; which he would not fail in doing if he pushed it forward with deliberate care, until the resistance offered by the uncut prostate gland and neck of the bladder ceased; until he caused fluid to escape from the bladder; or until he was stopped by the closed end of the staff. I may here remark that the appreciation of the first of the three signs, mentioned, of the bladder having been entered can only be acquired by practice, as it requires special "*tactus eruditus*" to feel the *loss of resistance* spoken of above; the second sign can, of course, only take place when there is fluid present in the bladder; and with reference to the third, the surgeon may be misled by the knife

not being arrested by the closed end of the staff, either from the defective construction of the latter, or from the point of the knife not being kept in close contact with and “grating along the groove.”

I would not refer to the question whether a moderate or a free incision is the best, the superior safety of the former being, in my opinion, self-evident, if it were not that Cooper in his dictionary advocates an incision of one inch or more through the left side of the prostate, if it be thought that the limited incision of eight or nine lines will not suffice. I cannot agree that when the stone is so large as to require additional space for its extraction, this should be obtained by the *free* incisions recommended by Cooper, instead of by following the judicious practice of the present day in making an incision through the right side of the prostate. Unquestionably, any unusual want of success in the practice of those operators who have made a moderate incision has resulted, either from their applying it to stones of a size to which the left lateral operation is not suitable; from their not incising the ligamentous ring at the neck of the bladder; from a want of dexterity and patience in effecting dilatation; or from their not making the external wound free nor depending enough to allow of the ready exit of the urine.

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Incision of right side
of prostate.

If incision of the right side of the prostate be necessary, the surgeon, having selected a straight narrow probe-pointed knife, should carefully pass it, with its edge directed towards the lower border of the right tuberosity of the ischium, along the staff through the right lobe of the prostate into the neck of the bladder, dividing the right side of the gland in the same manner as the left. If the staff has been withdrawn, it will give greater accuracy to the incision to introduce it again, but if this is impossible, the scalpel must be guided by the left forefinger in making this incision.*

Withdrawal of the
staff.

As will be more particularly referred to in the chapter on lithotomy in children, it is of much importance that the staff should not be withdrawn until the finger has entered the bladder, as it is required to direct the finger to the situation of the opening of the neck of the bladder, and also may be needed to guide the knife a second time to slightly enlarge the incision, in case it has been made to so limited an extent that the introduction of the finger cannot be effected.

Introduction of the
forceps.

Coulson says:—"Cases have occurred where the operator found it impossible to introduce the forceps at all, although the incision had been

* For further particulars on the subject of bilateral section of the prostate, the reader is referred to the chapter on Bilateral Section of the Prostate.

carried to the usual extent. This impediment may present itself in aged persons from rigidity or spasmodic contraction of the bladder."

If the obstacle to the introduction of the forceps proceed from the causes mentioned in the preceding paragraph; that arising from rigidity of the neck of the bladder might, I think, be overcome by dilatation of the part with the blunt gorget, or by incision of the right side of the prostate; while that from spasmodic contraction will generally cease on the full influence of chloroform being established, but if, notwithstanding this, the spasm should continue, and it be considered that further incision of the neck is not called for, an endeavour should be made to dilate the part sufficiently with the finger to pass a smaller-sized forceps. Supposing, however, these means to have been efficiently tried and failed, I would not hesitate to defer the operation to the next day, hoping that the spasm would pass off in the interim, and enable me to complete the operation *à deux temps*,—a proceeding which is, no doubt, under exceptional circumstances, a judicious one.

Author's observations.
Rigidity of cervix vesicæ.

Spasmodic contraction of cervix vesicæ.

Operation à deux temps.

Spence gives the following directions for seizing the stone:—"After feeling the stone with the closed forceps, by turning the blades away from the stone and then opening them, and making a half turn over in the direction of the stone, you

Seizure of the calculus.

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will generally seize it. In some cases there can be no great risk in opening the blades pretty widely and drawing them gently over the inferior and posterior parts of the bladder to catch the stone; but I have a great objection to sudden plunges, or opening and shutting the forceps rapidly in a hope of catching the stone, as this is apt to injure the coats of the bladder."

Cause of occasional failure.

Though this stage of the operation is easily accomplished if the operator conducts it with system and presence of mind; yet in the absence of these qualities, failure may readily take place, as in a case thus related by Crichton:—"After introducing the forceps and turning them in every direction, opening them and shutting them, shutting and opening for a great length of time—without grasping anything, he was observed becoming very much agitated;" yet the writer adds that a surgeon, a bystander, extracted this stone with great ease.

Difficulty in finding calculus.

Inability to find the concretion is occasionally a source of delay. Gross says that this may depend on concealment in a fold of mucous membrane or in the orifice of the ureter (the latter rarely); or on the stone being encysted, or "may be owing to the expulsion of the stone . . . at the moment of completing the section of the bladder and prostate gland."

In addition to the above, Poland, in Holmes'

‘Surgery,’ mentions another way in which the stone may escape observation: he says it may “become driven into the anterior part of the urethra or may have escaped into the rectum should the latter have been wounded.”

When the cause of embarrassment results from the calculus being lodged in the ureter, it will be very difficult to grasp and extract it: an endeavor may be made in the way Chelius directs: —“Stones which lodge in the ureter and project into the bladder must be loosened with the finger, carefully seized with the forceps, and attempted to be freed by gentle pulling.”

Stone lodged in ureter.

Coulson considers the difficulty of seizing the calculus depending on spasm of the bladder as one of the most serious that can be encountered; he writes, the bladder may be hypertrophied, “and at the same time contracted, firmly embracing the stone, or leaving but a small interval between the foreign body and the walls of the containing cavity. The bladder, also, in cases of this kind is often extremely irritable. When the bladder is closely applied on the surface of a large calculus, it will require all the dexterity and patience of an experienced operator to pass the blades of the forceps between the bladder and calculus without injuring or severely irritating the former.” Some writers, he continues, “advise us, under such circumstances, to

Contraction of the bladder from spasm.

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suspend our efforts for a short time, and wait until the contractions of the bladder have become less violent. This, perhaps, is more prudent than to go on irritating a diseased bladder with useless efforts."

Hour-glass
contraction of
bladder.

A still graver state than the one just described is that of hour-glass contraction of the bladder; but it is, fortunately, an extremely rare one: Coulson thus describes it:—"The stone appears to be retained in an anomalous position by some irregular action of the muscular fibres of the bladder analogous to the hour-glass contraction of the uterus. A case of this kind occurring during the lateral operation would be the cause of almost insurmountable difficulty. The action of the finger or knife is here out of the question; and even if the nature of the case were understood, the effort to pass the blades of the forceps between the stone and contracted cavity must be extremely injurious. Perhaps the only thing left under such untoward circumstances is the high operation. Every case has proved fatal in which the lateral operation has been applied."

On the other hand, neither Poland nor Ferguson considers spasm of the bladder to present such an almost insurmountable obstacle as Coulson does. Poland says:—"When there is much spasm of the bladder, and a kind of hour-glass contraction, it is best to wait a few moments

until it has subsided, and then carefully coax the forceps between the calculus and the walls, gentleness and patience being the chief treatment." Fergusson writes :—"It is by no means an uncommon supposition, that the bladder in certain cases encircles the stone so closely that there is no room to get the blades between; but this I fancy is a great error. No bladder that I have ever seen could resist the surgeon's power in expanding the blades, and pushing them in a proper direction." The possibility of injury to the bladder, however, if much force be used to overcome the spasm must not be overlooked. Sir B. Brodie relates a case in point :—"The surgeon in opening the forceps observed a resistance which suddenly gave way, as if a ligature had been broken." He adds that, on making a post-mortem examination, he "found that the mucous and muscular tissue of the bladder had been ruptured for about the extent of three quarters of an inch.

An equal or even greater obstacle to laying hold of the calculus, Coulson says, occurs "when a small calculus gets entangled between the meshes of a columnar bladder, and quite eludes our efforts to seize it with the forceps. Here unless we can succeed in dislodging the stone from its position either with the finger, the scoop or some analogous instrument, I cannot see what

Columnar bladder.

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is to be done. If we attempt to extract the foreign body without regard to the position it occupies, the coats of the bladder must be inevitably lacerated."

Collapsing bladder in old men.

Thompson mentions a cause of difficulty in seizing the calculus, which is distinct from that sometimes met with when a stone on account of its small size is hidden in the folds of the mucous lining of the bladder. This organ in elderly subjects, he states, may, from *collapsing* rather than contracting in the gush of water on completion of the deep incision, envelop the stone in its folds. In this complication, he says:—"Careful manipulation of the forceps, or better still of the scoop, with pressure by an assistant on the hypogastric region, will generally enable the surgeon to reach and remove it. . . . In these cases, it appears wiser to operate with a nearly empty bladder than a full one; the stone is then more likely to be found at the neck, close to the internal incision."

Author's observations.

An important element of success in performing this stage of the operation with dexterity and with safety to the patient, is to seize the calculus immediately the bladder is opened and before the urine can escape. When failure in doing this occurs, it is often due to inexpertness on the part of the operator, who, when he does not find the stone at or near the neck of the bladder, instead

A cause of delay in seizing the stone.

of at once raising the handles of the forceps and so turning the blades downwards to the floor of the vesical cavity, where the calculus will probably be found behind or somewhat beneath the prostate, passes them directly backwards to the posterior wall. The opportunity being lost, the bladder may contract on the calculus, and so increase the difficulty of the seizure of the stone; while the surgeon in his efforts may bruise the coats of the organ, and so diminish the chances of a successful result. That this has often occurred is established from the fact that in many of the patients who have died of the operation, the stone had been found or seized with difficulty, yet, even in such cases of delay, if the forceps are used with method and deliberation, as recommended in previous pages, and all sudden plunges and rapid opening and shutting of the blades especially avoided, the operation will probably be performed without an unusual amount of danger to the patient.

It may be laid down, as a general rule, that if the surgeon cannot seize a calculus with the forceps, he should endeavour to do so with the scoop, for even if he fail in completing extraction with the latter, the displacement of the stone, which will have taken place, will often enable him subsequently to lay hold of it with the forceps. The scoop is especially useful to disentangle a

Scoop when to be used.

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small stone enveloped in a fold of the mucous membrane, though this can sometimes be more readily accomplished with the finger, or by throwing water into the bladder in a full stream from a large syringe.

Failure in grasping
the stone.

Whenever difficulty from any cause is experienced in seizing the calculus, and if, after a fair trial by himself, the operator cannot bring the stone away, he should transfer the case to other hands, or defer the attempt for the present, lest prolonged and fruitless efforts should injure the bladder: in the latter case, when the stone is a small one, search should be made for it in all the discharges passed, or it may escape unobserved enveloped in a clot of blood or otherwise.

Hour-glass
contraction of
bladder.

With reference to the difficulty of grasping the calculus with the forceps due to spasmodic affections of the bladder, and especially to the variety depending on hour-glass contraction, my readers are referred to the several quotations given above. On this subject I would advise that, the full influence of chloroform being established, a patient attempt should be made to pass the forceps between the walls of the bladder and the stone; but that not more than moderate strength should be used, for, while believing that it is unlikely any bladder "could resist the surgeon's power in expanding the blades," I should fear lest rupture of the organ might take place, as in the case

recorded by Sir B. Brodie. If unsuccessful after employing as much force to overcome the spasm as I considered safe, I should still be loath to adopt Coulson's suggestion of the high operation (or, what would probably be a safer one, the recto-vesical) until I had waited for at least twenty-four hours in the hope of the spasm passing away in the mean time, so as, if possible, to afford relief in the usual way.

Though thinking that contraction of the bladder from spasm will often be successfully overcome by the full influence of chloroform, there is a state allied to it and of more common occurrence that, unhappily, cannot be so relieved, namely, where the bladder is habitually contracted upon a stone, and has thus become preternaturally small. In this condition, the same difficulty will be encountered in grasping and extracting the stone as if the contraction depended on true spasm, and the forceps must be employed with similar precautions.

Habitual contraction
of the bladder on the
stone.

The incisions and the method of extraction which are the most likely to enable the operator to successfully extract unusually large calculi without bilateral incision of prostate or crushing, are explained by Sir H. Thompson as follows:—

Extraction of large
calculi by single
incision only of
prostate.

“In order to introduce any large instrument, or to remove any large body by the lateral operation, room must be provided in the direction of

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the lower angle of the wound. The pubic arch limits the space, unalterably, in front; the ramus of the ischium equally so on the outer side; the rectum and coccyx occupy the middle line. Hence in withdrawing a large stone from the bladder, traction must be made obliquely downwards, and to the right side of the operator in the direction of least resistance, which is towards the hollow of the sacro-sciatic ligaments, where the fibres of the gluteus muscle only cross the *heart-shaped space*—the true outlet of the male pelvis.

Mechanical violence
in extraction.

The effects of.

The same author shows the serious effects resulting from extraction of a calculus through an inadequate internal incision:—"The student is taught to fear beyond all things an approach of his knife to the peripheral limits of the prostate . . . and in overdread of cutting it, he barely divides the prostate at all. . . . Hence the no less dangerous injury which results from violence inflicted by the forceps and by the stone upon the neck of the bladder, and from the powerful traction upon it, which injures, often irreparably, the loose cellular connections in which the viscus is embedded—connections which are delicate in structure, and loosely applied, for the purpose of permitting free extension of its parietes to the varying condition of size, which its function as a reservoir of urine demands.

. . . . Danger is always great in a ratio proportioned to the calculus, but this arises quite as much from the violence inflicted in removing it as from the depth of the incisions employed.

. . . . But, on the other hand, it is never to be forgotten that the neck of the bladder is susceptible of dilatation to a very considerable extent, if only it be gradually exerted. . . . But in order to take advantage of it the dilatation must be made slowly and gently. . . . If done hastily, harshly, and forcibly," it will cause rupture of the surrounding cellular connections of the prostate and neck of the bladder.

Besides the above-mentioned causes by which the prostate sustains injury during the extraction of a calculus, Poland mentions another:—"The gland is sometimes injured, in withdrawing the stone, by the forceps embracing a portion of it, and tearing it away from the body. This may be avoided by passing the finger below the forceps, and disengaging the gland from the forceps after the stone is seized."

Prostate may be seized by forceps.

It has been supposed that the cause of urinary infiltration was commonly from incising the prostate so freely as to wound its capsule; but this is not Sir H. Thompson's opinion as here expressed:—"There is good reason to believe that, in most cases, urinary extravasation is not

Mechanical violence a cause of urinary infiltration.

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the primary cause of the inflammation, but that inflammation has been the occasion of the urinary extravasation. Cellulitis, produced by violence, has first destroyed the connections of the neck and base of the bladder by sloughing, and then the urine has rapidly infiltrated the disintegrated tissue, and lighted up a virulent peritonitis, or intensified a previously existing one."

Calculus seized in its long diameter.

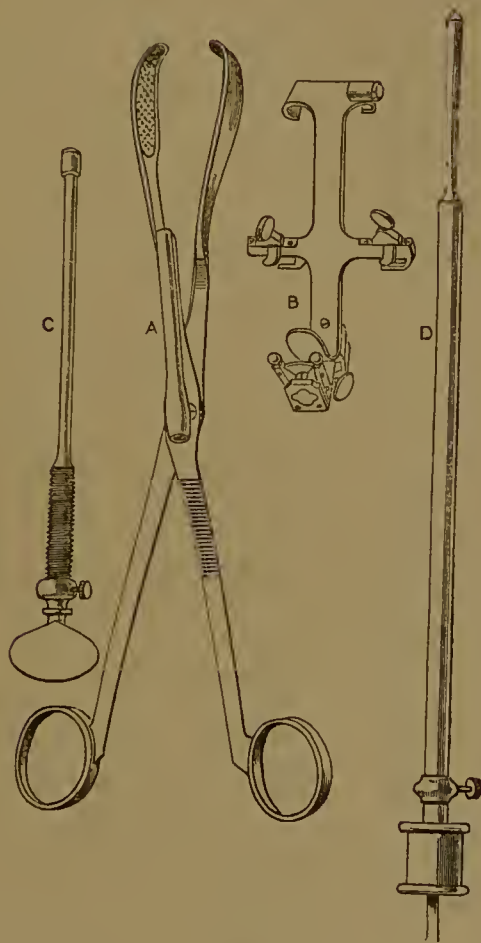
Coulson suggests that whenever the operator experiences much difficulty in extracting the stone, he should remember before proceeding to enlarge the internal wound, or break up the calculus, the possibility of his having grasped it in one of its long diameters; and in this event he should push the stone with his finger into a better position, or having dropped it should seize it again in its short diameter, though the latter course should not be adopted, he says, "without sufficient reason, and because of slight resistance to extraction; a great point is always gained when the calculus is once within the grasp of the forceps, and it may not be so easy to catch it the next time he tries."

Alternative courses for calculi too large for left lateral operation.

When the calculus is too large to be safely extracted through the ordinary incision of the left lobe of the prostate, Coulson says two courses are open to the operator:—"He may divide the opposite side of the prostate, or if this

prove insufficient he may break up the stone with a lithotrite or a pair of strong forceps."

Sir H. Thompson speaks of Civiale's forceps as Best forceps for crushing.



(Thompson.)

FIG. 6.—Apparatus for crushing the stone before withdrawing it in the operation of lithotomy. A. The forceps. B. Portion applied to the handle of the forceps and fixed there by screws, into which the piece C is inserted. C. Fixes the position of the stone between the blades of the forceps. D. A drill introduced through the tube, seen on the upper blade of the forceps, which, being turned either by the hand or by a bow, perforates and breaks up the stone.

the best for the crushing operation (see Fig. 6). He says they enable the operator to fix securely

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the stone between the blades before employing the drill to perforate and split it into fragments.

Several forceps of a much simpler construction than this are in use, and sold by Weiss, of London; their form is that of large and powerful lithotomy forceps, with a screw fixed in the handles, by which great power can be applied to crush the calculus.

Difficulties of
crushing.

The difficulties of crushing the calculus in lithotomy arise, according to Thompson, from three causes:—1st. “The manipulation requisite for fixing the stone securely in the grasp of the instrument when the bladder is emptied of fluid and for crushing it subsequently, must be always considerable, and liable to produce mischief.” 2nd. “The removal of numerous angular fragments from the empty bladder is a fruitful source of severe injury to it.” 3rd. “The danger of leaving some small fragment in the cavity renders much manipulation and much washing-out necessary, or the risk of a second formation may possibly be incurred.”

Circumstances
rendering crushing
inapplicable or
dangerous.

Coulson says that when the bladder is hypertrophied or strongly contracted on the calculus, there are strong objections to crushing.

Obstruction from
uncut muscular
or tendinous fibres.

I myself have often found uncut fibres of the transversus perinei muscle to impede extraction, while Lizars writes:—“In ordinary cases it is the fibres of the levator ani muscle, and

the deep perineal fascia, which obstruct extraction."

After having been brought through the prostate, the calculus occasionally, though rarely, slips from the grasp of the forceps. In such an event Spence says:—"The operator should insert his finger into the rectum so as to fix the stone from behind, and prevent it slipping back, and then with the curved lever end of the scoop draw or tilt it out of the wound."

Slipping of the stone after passing the prostate.

If a fusible calculus should be broken during extraction, it becomes necessary to wash out the bladder several times, and the practice recommended by Sir B. Brodie will be found a good one:—"When a fusible calculus containing a large proportion of the phosphate of lime is broken, it often happens that some of the fragments are of so small a size that they remain like patches of coarse sand in the bladder, even in spite of all the precautions you can take at the time of the operation. . . . Once or twice daily introduce a catheter by the urethra into the bladder, and inject half a pint of water . . . through it by means of an elastic bottle. The liquid flowing in by the catheter will flow out by the wound, carrying the particles of sand with it; and thus at last the bladder will be emptied of them. In a case of enlarged prostate, indeed, the plan may not answer," the injected fluid not passing away by

Washing-out of bladder after fracture of fusible calculus.

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the wound. "For these cases you must be provided with a large catheter having an aperture three or four times the size of that commonly made, close to the point on the upper or concave side. The liquid being injected by the catheter, will be discharged by it also, carrying every time some small fragments of calculi with it until none are left in the bladder."

Author's observations.
Traction to be made
patiently.

Extraction must be proceeded with deliberately, time being given for the neck of the bladder, the prostate gland, and the deep fascia to dilate and yield: the left forefinger should, at the same time, be pressed against the neck of the bladder to prevent its descending along with the calculus, and to afford a counter-extending point to the traction of the forceps. While making these persevering efforts, the operator must not be tempted to use the least violence to overcome any resistance he may feel, for by so doing the prostate may be dragged down before the stone even to the external surface, and if after this extraction should be effected, the surgeon will be unable to look forward to a successful issue of the case; but, the cellular connections of the gland with the surrounding parts having been torn asunder, must anticipate infiltration of urine with all its fatal consequences.

Cautious attempt by
left lateral incision
before adopting other
expedients.

Except when the calculus is palpably of so large a size as to leave no probability of success by the

left lateral incision, it is well for the operator to make a cautious attempt at extraction by this method, as it can seldom be told with certainty beforehand what is the exact size of the stone, or whether the parts may not be in so relaxed a state as will allow of the removal of an unusually large calculus without injury. If a trial be made, I cannot too strongly warn the young practitioner against the fault of continuing the attempt, from a dislike of failure, after he finds an unusual amount of resistance. Such pertinacity often leads to the parts being bruised, and thus diminishes the likelihood of success from any other measure, which may be considered necessary, as incision of the right side of the prostate or crushing of the stone.

It is remarkable to what an extent the parts will stretch without tearing, when dilatation is made during extraction with a firm and gentle hand, and in a very gradual and patient manner. If, besides this, the operator has previously given himself ample room externally by bringing his superficial incision well down towards the sacro-sciatic ligaments, where there is no bony structure to prevent the exit of a large body from the outlet of the pelvis, he will often be able to extract successfully larger calculi than would otherwise be practicable without the adoption of further expedients. This accords with the expe-

Left lateral incision
alone generally
sufficient.

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rience of Sir H. Thompson, who says that he has seldom found it necessary to have recourse to any auxiliary expedients; nor have I myself often been obliged to practise them, having generally been successful in accomplishing extraction by the above means, with the additional one of bringing forward the knees of the patient towards myself when operating, in order to produce relaxation of the parts through which the calculus is being withdrawn.

Measures auxiliary to the left lateral incision for large calculi.

When it is evident, either with or without a previous trial, that the left lateral incision alone, of the full extent of nine lines, does not afford sufficient space for the removal of a large calculus, it becomes necessary to decide on what auxiliary measures should be adopted—the question, generally, presenting one of two alternatives; either incision of the right side of the prostate gland, or crushing of the stone in the bladder. In considering the former proceeding, it must be remembered that incision of the right side of the prostate will only give a little more than half an inch of additional space in the internal part of the wound, and will seldom enable the operator to bring away a calculus more than half as large again,* as by the single left lateral incision. If, therefore, the calculus be thought

* Not, perhaps, so much as this. See Coulson's opinion on this subject, quoted in the chapter on the Bilateral Operation.

too large to be removed by the double incision of the gland, or if, after its adoption, the measure be found of no avail, the stone must be crushed with a strong crushing forceps; an exception to this practice being made when the bladder is diseased, highly irritable, or firmly contracted on the stone.

State of the bladder not suitable for crushing.

In the last-mentioned states the long-continued manipulations in seizing the calculus, and the sharpness of the fragments of the stone when crushed, are apt to set up extra-vesical cellulitis of almost as hopeless a type as that produced by infiltration of urine, and therefore, in this condition of the bladder, the recto-vesical operation will generally be safer. This latter method is also the best for calculi of excessive size, such as exceed seven or eight ounces in weight, that is, if the latter be thought fit for any form of operative relief. About this there may be a reasonable doubt, since hitherto only one patient in ten has survived the removal of such stones.

Recto-vesical operation when necessary.

In order to obtain a satisfactory result from the crushing operation, it is necessary, as above stated, to select suitable cases. The best kind of crushing forceps are those with which it is easy to seize the calculus, and which are at the same time strong enough to crush it, however hard it may be; and if such were always used with care for a period not exceeding eight or ten minutes,

Cases to be selected for crushing, and best kind of forceps to use.

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this method would, I believe, yield a better ratio of success than it has hitherto done.

Though recommending the recto-vesical as probably the best operation for the extraction of extremely large calculi, and for those so excessively hard as to resist the efforts at crushing them, I agree with Thompson, that as yet data are wanting to determine with certainty the value either of it or of the supra-pubic operation for such cases; but of the two I feel certain, notwithstanding its liability to be succeeded by permanent recto-vesical fistula, that the former is a preferable method to the latter one. This opinion I found on the fact that hitherto the ratio of deaths has been less than after the supra-pubic operation, and therefore I consider that the probability of even such an evil as permanent fistula should not prevent the surgeon from endeavouring to afford relief by the recto-vesical method.

Relative value of recto-vesical and supra-pubic operations.

Haphazard incisions of prostate, &c., to be avoided.

The late Mr Martineau advocated what I consider an objectionable practice as a means of overcoming obstacle during extraction. He says that after the stone is in the grasp of the forceps, the parts forming the stricture should be cut. These undefined incisions I cannot think safe, as they must endanger the capsule of the prostate. Neither do I approve of the advice of an eminent lithotomist, who says that the surgeon should

not hesitate to incise any part of the prostate gland, with the exception perhaps of the under surface, which offers great resistance to the extraction of a large stone.

CHAPTER IX

OBSTACLES TO LITHOTOMY

SECTION 1.—*Deep bladder*

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Cause of deep
bladder.

UNUSUAL depth of the bladder from the surface generally arises from enlarged prostate or obesity, and sometimes, though rarely, from a dilatation of the rectum.

Mode of examining
enlarged prostate.

Coulson gives the following directions for the best mode of examining the prostate when enlarged in cases of calculus:—"By introducing the finger into the rectum, &c., we must obtain as correct a notion as possible relative to the size of the gland; we must ascertain whether the whole or a part only of the prostate be enlarged, and if a part, whether it be the lateral or middle lobe; we must observe how the urethra has become altered, whether to the right, or left, or upwards," or whether its calibre is modified. "We must endeavour to find out, if possible, how far the middle lobe of the prostate projects backwards into the cavity of the bladder, and what is

the form or extent of the pouch in the floor of the bladder on which the calculus rests.”

Sir H. Thompson points out the modification External incision. required in the form of the external incision in these cases:—“It is necessary to make the external incision longer in proportion at both extremities, remembering that the incision in such a subject commences on a plane three quarters to one inch farther from the bladder than in an ordinary case. Otherwise the wound will be too narrow in proportion to its depth, and will be dangerously so should the stone be a large one.” His remarks respecting the use of the blunt gorget are as follows:—“The gorget is a safe and efficient instrument in these cases for extending the deep incision; it forms a conductor for the forceps into the bladder when the finger cannot reach it.”

Although I trust the *cutting* gorget has now Sir B. Brodie's views on the use of the cutting gorget. fallen into complete disuse, it may be useful in this chapter to contrast it with the *blunt* gorget. Long ago Sir B. Brodie disapproved of its use, but not of that of the blunt gorget. He especially mentions the liability of the former to slip out of the groove of the staff, and though this is equally the case with the latter, and is a reason for the exercise of great care in passing it, yet if the accident should take place, the gorget being blunt, the consequences would not be so serious. He says:—“There are considerable objections to

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it" (the *cutting* gorget), "the incision is made as the gorget is thrust into the bladder. In consequence of the thick wedge-like form of the instrument, the prostate, and especially a hard and enlarged prostate, offers to it considerable resistance. A certain quantity of force is necessary for its introduction, and if that force be not well applied, the beak may slip out of the groove of the staff into the space between the bladder and rectum." On the other hand, in allowing the employment of the *blunt* gorget in suitable cases, he says:—"The knife divides only a portion of the prostate. The gorget splits the remainder as far as its sheath allows it to do so. Do not for an instant suppose that this is any rude or violent proceeding. It is far otherwise. The incision of the prostate having been begun by the knife, the extension of it by means of the blunt gorget is accomplished with the greatest ease." He adds:—"You will ask, Why not make such a division of the part by cutting laterally with the knife? Why prefer the dilatation of the wound with the blunt gorget? . . . My answer is, that the separation of the parts with the latter instrument causes no hæmorrhage, and that it ceases as soon as it reaches the margin of the prostate; that is, as soon as it reaches the condensed cellular membrane, which forms what may be called its capsule. He continues:—"The sur-

Sir B. Brodie's views
on the blunt gorget.

geon then holding the handle of the blunt gorget with the left hand introduces the forceps with his right along the concave surface of the gorget into the bladder . . . you know when it has entered by the resistance ceasing, and, in many cases, by a gush of urine taking place at the same time. In a deep perineum the forceps will have to penetrate to a great depth before reaching the bladder. This is one of the sources of difficulty and doubt to a young surgeon, who is apt to think that the forceps must have actually entered the bladder, when it has, in reality, penetrated no farther than the prostate."

Deep perineum, resulting from enlarged prostate or other conditions, is in Coulson's opinion the most common cause of difficulty in grasping, and also sometimes presents an obstacle in extracting, a stone. He says:—"The great obstacle which considerable enlargement of the prostate causes, is to seizing the stone. It places the calculus beyond the reach of the finger, and a sure guide to the position of the foreign body is thus lost; while the distance of the vesical cavity from the external surface is greatly increased." He adds that the stone becomes lodged in a depression behind the neck, over which the instrument slides, "and the only way of overcoming the difficulty is to employ a

Seizure and
extraction of the
calculus.

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very long curved forceps, while, with the finger introduced into the rectum, we endeavour to raise up the stone from the depression behind the prostate in which it is lodged. But enlargement of the middle lobe, if carried to any excess, renders this latter proceeding generally impossible. The finger cannot reach beyond the enlarged lobe."

Author's suggestions.

When enlargement of the prostate gland is found to exist, the first thing to be done is to examine it carefully with the finger in the rectum, in the way recommended above by Coulson, and also by sounding; and recollecting that, from the unusual distance at which the bladder lies from the surface of the perineum (in one case mentioned by Spence as much as six and a half inches), unless the external incision is free, the lithotomy wound will be, in the words of Thompson, "too narrow in proportion to its depth," the operator should make it of full length (seldom less than three and a half inches, sometimes a quarter of an inch longer) commencing from one and a half to one and three quarter inches in front of the anus and terminating fully one inch beyond it. In these patients the internal incision is best made by holding the scalpel *above the fingers and below the thumb*, pushing it forward along the staff, and, while guarding against its too deep entrance into the bladder, it

must be borne in mind that it may occasionally be necessary to pass it to an unusual depth, according to my own experience, of even four and a half inches from the surface. Though I myself always make the internal incision in these cases with the ordinary sharp-pointed lithotomy scalpel, yet I think it well to mention that some authorities, on account of the great depth to which it has to penetrate, recommend the young operator to substitute a probe-pointed scalpel at this stage of the operation, and I approve of his doing so, except when he finds the least difficulty in inserting the probe end of the scalpel into the exact part of the urethra that has been opened, in which case he should at once resume the sharp-pointed knife. Whichever is preferred, its point should not be allowed to leave the guidance of the staff in order to extend the incision by cutting laterally; but when additional room is required, a blunt gorget should be passed along the groove into the bladder, and the staff being withdrawn, the gorget can be used both to dilate the wound, and also to conduct the forceps into the bladder when too deep for the operator to reach it with his finger. In a case in which the finger is not long enough to reach the bladder, and in which it has not been necessary to insert the gorget, there being consequently no guide to conduct the forceps into that organ, extra cau-

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tion must be used in the introduction of the latter instrument; the operator, in the words of Ferguson, "taking care, under such circumstances, that force is not used, for if he has cut into the bladder the forceps should glide along with a gentle push." A gorget which is $\frac{7}{8}$ ths of an inch wide will often be found an efficient instrument, though, for some cases of enlarged prostate, one with a width of $1\frac{1}{8}$ inch will be better. It should be of a tapering form, for it will then pass more readily through the internal wound than one of a wedge-shape would do. While thinking the blunt gorget a valuable instrument in suitable cases, I must impress upon my readers the importance of inserting it in a slow and gradual manner along the staff and as parallel as possible with it, so that during its introduction it may dilate rather than lacerate the parts, and that its action on the prostate and neck of the bladder may be limited to an extent equal to little more than its own breadth.

Cutting gorget.

I need add nothing to Brodie's warning words, quoted above, against the cutting gorget; but will only remark that although its use is discarded in the present day, its one advantage is retained in the blunt gorget, namely, in enabling the surgeon to make the internal incision to certain, instead of uncertain measurements; whilst also the employment of the latter does not involve the

dangers inherent in the use of a cutting instrument of the shape of a gorget.

With reference to the lithotome or bistourie Bistourie cachée. cachée which is now, I am glad to say, never used in English practice, I will only observe that it is the same in principle as the *cutting* gorget in so far as it is intended to enable the operator to cut the prostate and neck of the bladder to a *definite* extent; but it is a still more objectionable instrument, as it incises that part deeply which ought to be notched only, namely, the neck of the bladder, and thus makes a very dangerous internal incision.

After the incisions have been completed and the forceps introduced, the most difficult part of the operation in many cases still remains to be performed, and in anticipation of this the operator should provide himself with long and strongly curved forceps, as sometimes it may be needful to make use of one curved almost at right angles with which to dip into the hollow behind the prostate, the stone at the same time when within reach of the finger, inserted into the rectum, being raised by it towards the forceps. A flat calculus, however, in this position may require to be displaced by the scoop before it can be seized by the forceps. Seizure and extraction.

In cases of enlarged prostate it may be necessary to use a staff curved upward for the last two Form of staff.

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or three inches, such as will ride over the obstruction.

Fracture of calculus
and washing out of
bladder.

If the calculus were a fusible one, and broken during extraction, it would be necessary to wash out the bladder once or twice a day on Sir B. Brodie's plan, as given at page 177, the latter part of which quotation refers especially to the accident as met with in enlarged prostate.

After-treatment.

The after-treatment of patients with enlarged prostate does not differ from that of others, except that the sudden supervention of collapse must be carefully guarded against, weak heart being common in such men, and in this state of cardiac debility even a small amount of secondary hæmorrhage will sometimes cause such alarming symptoms as to necessitate the giving of brandy and sulphuric ether at short intervals to induce reaction.

SECTION 2.—*Rigidity of the Neck of the Bladder*

Along with the enlargement of the prostate in elderly patients, there may be found unusual rigidity of the neck of the bladder. This will not modify the treatment with the knife and blunt gorget, as recommended above, except by lengthening the distance it may be necessary to travel upon the staff before a sufficient opening

can be made into the neck of the bladder. This state may increase the difficulty and danger of the operation, for, as Coulson says:—"Hypertrophy with induration of the prostate, and a want of extensibility in the neck of the bladder, will present obstacles to the extraction of the calculus, because the parts just named do not dilate sufficiently to let the stone pass with ease through the wound. Laceration of the gland and neck of the bladder has sometimes been the result of this condition in old persons." Thompson remarks that in these circumstances the bilateral operation may sometimes be advisable. He writes:—"In a marked case the tissues yield little to the finger or to the forceps. . . . The forceps being introduced it is perceived that dilatation is not taking place. . . . In either case risk is incurred by violent laceration, or by extended incision; the smaller risk, however, probably lies, in careful hands, with the latter, although it is undoubtedly true that more force is admissible in this condition than in the normal state of the tissues." He adds:—"When this condition is marked, and the stone is large, a second incision may be made through the right side of the prostate, supposing that in the left to be already sufficiently free."

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SECTION 3. — *Tumours about the Neck of the Bladder, and embedded in the Prostate Gland.*

Coulson writes :—“ The irritation of a calculus in the bladder sometimes gives rise to the development of tumours generally about the neck of this organ. These are either of a fungoid character, or resemble polypi.” In another part of his work he says :—“ The growth most commonly met with is the one known as medullary fungus, or fungus hæmatodes. . . . These tumours usually occupy the neck of the bladder, but they may grow from other parts ; they are sometimes covered with calcareous incrustation, and sometimes the calculus itself seems to grow into their interstices.”

Diagnosis from
enlargement of the
prostate gland.

With reference to the diagnosis of tumours from enlargement of the prostate, Coulson writes :—“ It is important to distinguish chronic enlargement of the middle lobe from the various kinds of tumours about the neck of the bladder . . . but this is not always easy. The practitioner should chiefly be guided by the anatomical position of the gland, by the manner in which the middle lobe springs, as it were, from the under surface of the neck of the bladder, and by the large basis on which it is supported.”

Sir H. Thompson mentions the liability there

is to the accidental removal of tumours of the prostate gland by laceration, when operating on elderly patients:—“It may occur in two very different ways: first, it sometimes, but rarely, happens that section of the prostate gland divides or exposes freely one of those small rounded tumours which so frequently exist embedded in the substance of the organ, especially in elderly patients; under which circumstances the tumour becomes very easily enucleated. Secondly, when an outgrowth, more or less projecting or pedunculated, exists at the neck of the bladder, springing from the prostate into the vesical cavity, it is apt to be caught between the blades of the forceps when seizing the stone, and to be torn off in the act of removing it.” This, he writes, has many times occurred without endangering life, though, he says, it should be avoided, and that it is advisable, with this object, to ascertain “the presence of prostatic growth, and guard it from inclusion or laceration when the operator is dealing with a patient of advanced age.” He adds, if “he determines to get rid of it, as is sometimes done, it is better to do so with probe-pointed scissors than by tearing it off.”

When the prostate is enlarged from the presence of tumour, this author recommends that the blunt gorget should be used not only for the

The use of the blunt
gorget recommended.

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same reasons as in other cases of enlargement of the gland; but also because it “ keeps projecting tumours out of the blades ” (of the forceps) “ which might otherwise be lacerated or brought away in their grasp.”

Author's
suggestions.

When the calculus can be extracted without excision of the tumour, I think it should be done; but if it is so placed that it is impossible to get at it without the preliminary removal of the tumour, it will then be allowable to cut it off, if a *benign* one, by means of the probe-pointed scissors. If *malignant*, it ought never to be excised, nor any operation for the removal of the calculus performed, as acceleration of death will be the almost certain result.

During extraction, a pedunculated tumour of the neck of the bladder is sometimes brought down in front of the calculus, and will then be in danger of being torn off. Here, instead of excising the tumour, an endeavour should be made to push it aside so as to guard it from injury while the stone is being extracted.

Diagnosis of
malignant disease of
the bladder.

It is a matter of much consequence to make the diagnosis of malignant disease of the bladder; some of the signs of which, chiefly derived from Prout's writings, are here given. Malignant disease of the bladder generally assumes the form of fungus hæmatodes, often attacking the neck of the bladder or its neighbourhood. Prout writes :

—“The cachexia is marked, and hæmorrhage is one of the most frequent symptoms, until at last it becomes almost constant.” The urine contains “a dark coloured offensive bloody sanies.” The important changes in the characters of the blood in malignant disease are thus noticed by him:—“The red particles of the blood discharged in the earlier stages of fungoid disease have often a remarkable appearance, and appear to the eye larger than natural; so that after they have subsided to the bottom of the urine, they at first sight somewhat resemble grains of lithic-acid gravel, and like that substance, when the vessel is inclined, may be distinctly seen to roll along the bottom. From this peculiar appearance of the red particles of the blood, the presence of malignant disease may be often suspected before the symptoms assume a decided character.” If in malignant disease of the bladder the cancer cell could be found on examining the urine microscopically, the diagnosis would be greatly simplified; but unfortunately this is not the case, and it is Sir H. Thompson’s opinion that the characteristic forms of cancer cell are not met with, though large quantities of epithelium are often present, which he thinks may “have been mistaken sometimes for the so-called ‘cancer cell.’”

The elongations of the mucous membrane of the bladder, which are occasionally the result of

Diagnosis of elongation of the mucous membrane when encrusted with phosphatic deposit.

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Also diagnosis of
hypertrophied
columnus.

the irritation of calculus, may become encrusted with phosphatic deposit, simulating calculus in the bladder, and so may the hypertrophied columns of the columnar bladder, though to a less degree. The most distinctive diagnostic mark is their *fixed* condition, a character absent in all descriptions of calculi suitable for operation. If by accident such a growth should be laid hold of, the precaution, previously recommended, of never omitting before extraction to rotate the forceps a little on their own axis, in order to test the freedom of movement of the instrument, will detect the *fixed* condition of the mass in time to prevent injury to the bladder.

SECTION 4.—*Bar of the Neck of the Bladder.*

Bar at the neck of the bladder is very analogous in its seat and effects to enlargement of the middle lobe of the prostate; and the treatment, when met with in conjunction with calculus, will be the same. Mr Coulson's description of it is as follows:—"In old patients affected with calculi we sometimes meet with a peculiar structure at the neck of the bladder, which Mr Guthrie has well described under the name of 'bar of the neck of the bladder.' . . . This obstruction is

generally observed in old persons who have laboured for a considerable time under vesical calculus. It is formed by hypertrophy of the sub-mucous cellular tissue, which rises up like a bar and stretches across the neck of the bladder just behind the middle lobe of the prostate.

. . . . The length of the bar varies from one to two inches, and it may rise to a height of half an inch, being sometimes a quarter of an inch in thickness."

CHAPTER X

ENCYSTED AND SACCULATED CALCULI

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Encysted calculus.
Prognosis.

THE condition of a man with encysted calculus is a most hopeless one, for it is very seldom proper to attempt to give him operative relief, and the presence of the stone must eventually produce serious disease of the bladder. Sometimes, after the stone has increased in size and weight, ulceration of the coats of the bladder ensues from its constant pressure. Another result, mentioned by Mr Coulson, is that purulent inflammation of the walls of the bladder is often excited by the sojourn of foetid urine in the cysts.

Frequency.

It is of rare occurrence.

Cause of formation of
cysts.

Mr Miller, in his 'Surgery,' mentions three ways in which cysts may be produced:—"By internal opening of a parietal abscess; by hernial protrusion of the mucous coat outwards through the muscular; by deepening and enlargement of a depression between the hypertrophied fasciculi." The second is the most usual of the three causes

of cyst, and it has been observed that the calculus may either be originally formed in it or become engaged in it subsequently.

The modification, the symptoms of calculus in Symptoms. the bladder undergo when the stone is encysted, is well treated of by Mr Erichsen :—"Those symptoms which depend upon its being loose and rolling about the bladder are necessarily absent; thus there is no stoppage of the urine, this fluid is seldom bloody, and the pain is not materially increased by jolts and rough movements; though there are weight and pain in the usual situations, and increased frequency of micturition from the pressure and irritation of the calculus." The suffering is sometimes very slight; thus, in two patients mentioned by Dr Prout, who had been afflicted for twenty and ten years respectively, the only inconvenience was occasional slight irritation and hæmorrhage after exercise.

Mr Erichsen writes :—"A calculus may be Sounding. generally known to be *encysted* if the sound strike it at times and not at others; if the stone always appear to be fixed in one situation; and if the beak cannot be made to pass round it, so as to isolate it, but feel a kind of tumour projecting through the walls of the bladder, around or on one side of the point where the calculus is struck." The chance of striking the stone is sometimes very occasional only, for it may be so completely

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Treatment.

encysted that a small part alone of its surface is exposed at the mouth of the cyst.

Mr Coulson speaks very unfavorably of the chances of success from an operation :—" Could it be ascertained with any certainty before an operation has been undertaken that the stone is actually lodged in one of these sacs, I am decidedly of opinion that lithotomy should not be had recourse to, because it is ten to one that the operation will turn out to have been useless." When, however, the bladder has been cut into, in considering the measures to be taken under such circumstances, he says :—" Two main points are to be borne in mind. The stone may be completely encysted and the entrance into the sac may be narrow, or its orifice may be wide, and a portion of the stone project into the bladder. When the stone is completely encysted, I am decidedly of opinion that no attempt should be made to dislodge it by incision of the neck of the sac. The operation must be left unfinished.

. . . On the other hand, when the calculus is only partially contained in the cyst, and the orifice of the latter does not embrace it tightly

. . . an attempt may be made to complete the operation." In this latter case an endeavour should be made to seize and dislodge the calculus with the forceps aided by the finger, or, if this is not long enough, assisted by a probe, the scoop or

other blunt instrument, with which also careful efforts should be used to enlarge the orifice of the cyst : this was done by Crichton on one occasion with a female grooved staff, which he introduced cautiously through the narrow aperture of the cyst, and then gently and cautiously causing it to make its way by the side of the encysted portion till it reached its base, he with a good deal of difficulty disentangled the calculus from its pouch.

Sir B. Brodie relates one case in which having dilated the neck of the sac with a probe-pointed bistoury, he succeeded in separating the calculus from the cyst with his finger, and so was enabled to grasp it with the forceps.

A somewhat similar case was recorded in the 'Dispensary Reports' of the North Western Provinces of India for 1869, in which the stone was grasped, and, traction being made, the cyst came into view, whereupon the mouth of the cyst was slightly cut and extraction was accomplished.

It should be observed that in both these cases the surgeon was able to guide the knife with the finger ; but here Coulson makes the important remark that if the finger can reach the cyst, he would much prefer dilating its orifice to cutting it.

A very rare form of encysted stone occurs

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Stone encysted in
ureter.

when it is fixed in the extremity of the ureter. A case is recorded in 'Cooper's Dictionary' of this kind, which was shaken occasionally with a pair of forceps until it fell into the bladder, and was then extracted.

Author's observations.

My own experience coincides with that of Coulson, that no operation ought to be performed for encysted calculus; and fortunately there is less urgent need for interference than in the ordinary kind of calculus, as the sufferings of the patient are generally much less, and his life may be prolonged in a state of comparative comfort for several years. If, however, an attempt at operative relief should be made, I think it would be the safest practice not to attempt to extract it by dilatation of the orifice of the cyst with a knife, but to do so with the finger or a blunt instrument, as strongly urged by Mr Lane, who says cutting instruments ought never to be employed in such cases. In grasping the calculus much caution must be exercised, for, as Solly has brought to notice, the stone by its pressure may have set up ulceration of the coats of the bladder at its site, the mucous and muscular coats perhaps being destroyed, when, should the forceps be opened carelessly, they may split the peritoneum. In a case of sacculated stone, in which ulceration was suspected to exist, he says, extraction was care-

fully performed with the scoop instead of the forceps.

Sir H. Thompson explains the distinction between a sacculated and an encysted calculus :—
 “By cyst I mean a cavity in the walls of the bladder, fitting to and embracing closely the stone which is always lodged in it; by sac, one of those large dilatations of one or more of the vesical coats found independently of stone, but in which one may sometimes be lodged.”

Sacculated calculus.

Distinction from encysted calculus.

It is rarer than encysted stone.

Frequency.

There are symptoms of a striking character, described by Mr Bryant, which indicate that either a sacculated calculus is present or that one has recently existed :—“Sometimes the bladder symptoms may be severe for a time and then cease, or suddenly appear after any extra exertion. In the former case, the stone probably becomes fixed in a sacculus and ceases to irritate as a foreign body; in the latter, it escapes from the sacculus and makes its presence known.”

Symptoms.

A sacculated condition of the bladder may be suspected, if on repeated soundings the stone sometimes, from being loose in the cavity of the bladder, is readily struck; but at other times, from having escaped into the sac, can by no possibility be reached.

Sounding.

The possible existence of this state is one great reason why, if the calculus cannot be clearly

Caution.

CHAP. X.

struck with the sound at the time of the operation, no incision should be made.

Treatment.

The treatment is the same as that for encysted calculus.

CHAPTER XI

ADHERENT CALCULUS

TRUE adherent calculus, namely, that in which organic connection exists between the mucous lining of the bladder and the calculus, is said by Sir H. Thompson to be excessively rare.

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Frequency of occurrence.

Dr Prout also considered it to be of very rare occurrence, and that it is principally confined to phosphatic concretions.

Mr Coulson says that when the bladder is in a columnar condition the calculus may appear to be adherent without really being so:—"The stone does not literally adhere, but any projections on its surface may get entangled amongst the network of the hypertrophied fibres."

A projecting calculous mass connected with an encysted portion may, on a superficial examination, be thought to be an adherent stone.

There is, however, a rare form of adherent calculus which consists in calcareous matter being deposited on the lining membrane of the bladder, unconnected with an encysted portion; any at-

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—

tempt to remove which would tear away the tissue with it. This is met with in cases of phosphatic calculi, and therefore the operator when extracting such should be on his guard against trying to remove any calcareous substance which appears to be adherent.

Treatment.

True adherent calculus would be unfit for any surgical expedient; but it is so very rare that, judging from the subjoined paragraph, Sir Wm. Fergusson has never met with such a case:—"As to adhesion of a stone to the bladder being an impediment to the fair performance of the operation, I believe it to be a myth; I certainly have seen instances where the bladder and stone have held close approximation by asperities on both, but it never appeared to me that these could for an instant withstand the influence of the surgeon's hand on the forceps."

CHAPTER XII

ACCIDENTS AND COMPLICATIONS DURING AND AFTER OPERATION

SECTION 1.—*Hæmorrhage*

Accidents during the lateral operation of lithotomy.

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—Those which most often occur, Mr Erichsen says, “are hæmorrhage; cutting the bulb; missing the membranous portion of the urethra; wound of the rectum; or wound of the posterior part of the bladder.” To these I would add, as being a very serious and not uncommon accident—wound of the capsule of the prostate gland.

Sir H. Thompson says, “Death by primary hæmorrhage may be said almost never to occur.”

Primary arterial hæmorrhage.

Prognosis.

Primary arterial hæmorrhage to a serious extent is not a common accident, the artery of the bulb or the internal pudic artery being not very often wounded, while the smaller arterial branches of the perineum when cut do not cause the loss of much blood. Though the irregular distribution of the larger arteries is the most common cause

Frequency.

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Cause of artery of
bulb being wounded.

of their being divided, it may also arise from the fault of the operator, who may cut the artery of the bulb by commencing his first incision too high and at a distance from the raphé; by pushing in the knife deeply at the upper part of the wound instead of confining the incision at that part to the external textures only, or by lateralising the knife too early. This artery is especially liable to be injured when the perineum is very deep; even then, however, the operator can avoid the accident by being careful not to cut upon the staff too much forward, but to enter it immediately in front of the prostate, and in doing this he must keep his deep incisions low down towards the base of the triangular ligament.

Cause of internal
pudic artery
wounded.

The trunk of the internal pudic artery is so well protected by the ramus of the ischium that a surgeon must be very careless indeed who wounds it when it is normally placed; but when, instead of being bound down by fascia to the bone, it leaves the bone and, after ascending above the tuberosity of the ischium, inclines more or less towards the middle line of the perineum, it is then particularly liable to be cut if the surgeon lateralise his knife much or terminate his incision close to the ramus of the ischium. Anteriorly, however, this artery, in its normal state, after it has given off the branch to the bulb becomes more superficial than in the rest of its course, for it comes

to lie between the layers of the transverse ligament, where it may be wounded in withdrawing the scalpel after the completion of the internal incision, if the knife is not kept in close contact with the staff, but is allowed to wander away outwards with its blade looking horizontally.

An artery being wounded, the hæmorrhage if Treatment. abundant should be temporarily controlled by pressure, and, if this can be effected, the operation should be completed before an endeavour is made to tie the vessel, lest the ligature should be torn off during the extraction of the calculus.

The attempt, however, to tie either the artery of the bulb or the internal pudic artery will seldom succeed unless the perineum be very shallow, for the former lies so deeply under the arch of the pubes, and the latter is so closely bound down by fascia under the ramus of the ischium, that the orifice from which the blood is flowing cannot be seen. A trial should nevertheless be made to tie these arteries when wounded. The attempt to secure the artery of the bulb will be facilitated by extending the incision upwards, and Poland says, by the use of the tenaculum or compressing forceps: acupressure may be tried, or the recommendation of Sir H. Thompson adopted, who writes that the ligature "may, perhaps, be passed beneath by means of a curved needle, and the current stopped by a knot made

Divided arteries to be tied if possible.

on the bleeding point." He also says that "a safe and efficient mode, when the difficulty is great, is to use a tenaculum of the common form, but connected with its handle by means of a screw, so that the handle can be detached at pleasure" (Fig. 7); "the hook of the instrument is



(Thompson.)

FIG. 7.—Tenaculum, with removable handle (Dr. Keith). At *a*, the hook unites with the handle by a screw, and can be separated from it, for the purpose of leaving it in the wound beneath a deep-seated vessel, after tying round it, when the ligatures cannot be secured otherwise.

passed under the mouth of the vessel, a noose of thread or silk is thrown around the soft parts beneath and tied; the handle is then unscrewed, and the hook left in its place. . . . In one instance the instrument remained ten days in the wound."

In the case of wound of the internal pudic artery, an instance is recorded in which Sir B. Brodie succeeded in ligaturing it:—The hæmorrhage having been temporarily arrested by means of manual pressure, he passed a ligature around the trunk of the vessel by means of a small flexible silver needle.

When all other methods to arrest the hæmor-

rhage have failed, Thompson says, “a ligature placed round the pudic artery as it lies under the ischio-pubic ramus has been found successful. It may be accomplished in the following manner : —A short needle curved at its point, and carrying a strong silk thread, is introduced through the soft structures which lie on the ramus, close to the bone at its anterior border, and brought out again about three quarters of an inch deeper in, so as to pass under the pubic trunk, the two ends are tightly tied, and if properly done, the closure of the vessel must be the result.”

The superficial branches, unless enlarged, seldom furnish a serious quantity of blood ; when, however, they do so, they may be tied or twisted if their orifice can be caught hold of, but if not, their bleeding can easily be controlled by plugging.

Failing to ligature the artery of the bulb or the pudic, the hæmorrhage must be arrested by manual pressure applied to the latter vessel where it lies on the inner side of the ascending ramus of the ischium ; to employ it efficiently, relays of assistants should relieve each other at intervals of not less than two or three hours, the change of finger being made as cautiously as possible, and the pressure should be kept up for a period of from twelve to twenty-four hours, or longer, as much as forty hours being said to

Manual pressure
when to be applied.

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have elapsed before the patient was considered safe.

Primary venous
hæmorrhage

Primary venous hæmorrhage sometimes happens, and it is well to remember that this, as well as the other forms of bleeding, may not show itself at once by the wound; but may pass backwards into the bladder, escaping *subsequently* with the urine. It may occur, though not to a very serious extent, from wound of the bulb, if the first incision is commenced too high, and the bulb, which in old men overlaps the membranous portion of the urethra, is not pushed aside.

Wound of bulb.

Wound of venous
plexus.

The venous plexus around the prostate gland and neck of the bladder, which is generally varicose in aged patients, and in those who have long suffered from irritation of the urinary organs, is liable to be wounded where it lies about the apex of the gland, causing a dangerous form of hæmorrhage, the venous character of which may be recognised by the blood being of a dark colour, and by its not coming from the wound in jets like arterial blood. My practice has always been to plug the wound by means of a tube wrapped round with folds of lint, saturated usually with tincture of iron; and while it has remained in the bladder, great attention has been paid to the free escape of urine through it, by the occasional introduction of the feather of a pen or a bougie to free it from coagula. The best form of tube

Treatment by
plugging.

and the precautions necessary in its introduction are described at page 136. The tube when covered thickly with folds of lint, being often difficult of introduction in the hands of those unaccustomed to it, the “canule à chemise” of Dupuytren may be found a better instrument for general use. In this form (Fig. 8), the tube is



FIG. 8.—Canule à chemise. Copied from Butcher's 'Conservative Surgery,' but reduced in size.

employed by tying a piece of thick muslin around it in the form of a petticoat about an inch from the end, long enough to reach to the opposite end,

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and between the folds of which and the tube (after its introduction) strips of lint can be stuffed, so as to exert pressure on the sides of the wound. At the end of twenty-four or forty-eight hours, or when the tendency to hæmorrhage appears quite to have ceased, the apparatus must be removed, taking out first the lint little by little, and finally the tube itself; this must be done not roughly and hastily, but by means of a gentle twisting motion, lest bleeding should be again brought on from the tearing away of the plugs of coagula sealing the mouths of the wounded vessels. Plugging very seldom fails to arrest venous, or the slighter cases of arterial bleeding.

Cold irrigation, &c.

In addition to plugging, or now and then without its aid, the hæmorrhage may be stopped by one or more of the following measures: by keeping the patient cool; by swabbing the whole of the wound as high as the neck of the bladder with tincture of iron; by raising the pelvis well and pouring cold water from a height over the sacrum, pubes, perineum, and wound; by iced water irrigation; by washing out the bladder with cold water, and, when the bulb is wounded, by continued manual compression of it against the pubic arch. A last, but very efficient resource is to wipe out the wound with the actual cautery.

Internal hæmorrhage.

When the bladder is distended with blood, though little or none may have appeared exter-

nally by the wound, it may be known by the patient suffering from the general symptoms of loss of blood, and by dulness on percussion in the hypogastrium. Cold water must be gently injected into the vesical cavity in a full stream to clear out all coagula of blood, and then, if the bleeding is found to be arterial, the vessel should be tied when possible; but if this cannot be done, or if the bleeding is venous, the flow of blood must be arrested by manual pressure or by plugging. In these and all other cases, when collapse has supervened, stimulants must be given to induce reaction. Stimulants needed.

Secondary hæmorrhage, though more dangerous than the primary form, is seldom *immediately* fatal; but, if the bleeding is not permanently stopped, being allowed time after time to recur, it exhausts the powers of life, and prevents adhesion in the newly cut surfaces of the wound, and so interferes with the natural process by which absorption and consequent infiltration of urine are avoided. Secondary hæmorrhage. Prognosis.

It is more common than primary hæmorrhage, and generally comes on from the sixth to the tenth day after the operation, but may do so as early as the third, or as late as the fifteenth day. The hæmorrhagic diathesis is a strong predisposing cause of a troublesome, and generally fatal form of secondary hæmorrhage. Cause.

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It sometimes occurs without any apparent cause; at other times, particularly in aged and weakly patients, it is due to asthenic ulceration attacking the wound and causing sloughing.

Cruveilhier's opinion of cause.

Cruveilhier was of opinion that in most cases it was the result of inflammation, which, by relaxing the walls of the divided vessels, allowed the clot to become detached from their mouths.

Purgative may cause it.

Occasionally, it has followed the action of a strong purgative, especially when the motions have been hard, the clots in the prostatic and other veins having by that means been loosened.

Mode of attack.

The attack generally comes on suddenly, without warning, though a few show a tendency to it from the first: in these the urine, which after the operation is always of a reddish colour, instead of gradually becoming clear, remains hæmorrhagic until the bleeding sets in. Judging from the experience of such cases, I think that whenever the urine remains tinged with blood after the third day, the case should be looked upon as one liable to an attack of hæmorrhage, and means should be taken to prevent it if possible. Meanwhile, the dressings and bed-clothes should be frequently examined to discover the earliest signs of its approach in case it should come on, it being borne in mind that, as in primary hæmorrhage, the blood may not show

itself externally, but may flow back into the bladder.

Plugging, as for primary venous hæmorrhage, Treatment by plugging. combined with the internal administration of dilute sulphuric acid, gallic acid, or tincture of iron, has always been successful in my practice. Key disapproved of plugging, as likely to cause inflammation of the cellular tissue of the pelvis: this has, however, not been my experience of its effects, and I am strongly of opinion that any irritation of the wound it may produce affects the prognosis less unfavorably than delay in controlling the hæmorrhage would do, owing to the use of inefficient remedies. Delay in treatment hurtful. Much loss of blood causes great debility, and often reduces the patient to such a state of exhaustion that he gradually sinks without making any effort at a reparative process, or is cut off by pyæmia or other disease of a low type. South mentions an instructive but fatal case in a lad in whom, no efficient measures being taken, the bleeding, though moderate in its attacks, continued to recur until the patient was almost completely drained of blood. The case is so typical a one that an account of it will be useful:—The bleeding commenced on the sixth day, and he passed clots of blood at intervals until the twenty-second day after the operation, when compression of the pudic was had recourse to. The bleeding, he

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says, “must have been from the transverse perineal artery, and . . . had I made pressure on it at first as I did at last, the boy might have been saved. . . . At the time I did not recollect the occurrence of after-bleeding in a case of this kind, and when the bleeding ceased for a time, and the child again began to improve, I had hoped that the danger had passed away.”

Treatment by other measures.

If other means should be preferred, the most likely to succeed will be one or more of the following:—ligature, if possible, when the source of the hæmorrhage is arterial; touching the bleeding point with tincture of iron, if the spot can be ascertained by the bleeding being arrested when pressure is made upon it by the finger; irrigation of the perineum and hypogastric region with cold water; manual pressure of the internal pudic artery (as described under primary arterial hæmorrhage) kept up for many hours; or lastly, as in every other form of hæmorrhage after lithotomy, the actual cautery may be used as a *dernier ressort*.

Retention of urine from coagulated blood.

Prout's directions for the treatment of retention of urine from coagulated blood, when it occurs in a case of hæmaturia, apply equally to that caused by hæmorrhage after lithotomy:—“When the bladder becomes distended with blood, and complete retention of urine in con-

sequence takes place, recourse must be had to a large-eyed catheter, and an exhausting syringe, by aid of which, and the occasional injection of cold water, the coagula may be broken down and removed. If the hæmorrhage be so profuse that the bladder becomes again distended with blood in a very short time, the injection of cold water into the rectum or bladder is sometimes of great use; and should these means fail, from twenty to forty grains of alum may be dissolved in each pint of water injected into the bladder, a remedy that seldom fails to check the bleeding even when the cause is malignant disease. I have never known any unpleasant consequences follow the use of this expedient; and have seen it immediately arrest the most formidable hæmorrhage when all other means had failed, and when the bladder had repeatedly become again distended with blood, almost immediately after its removal."

SECTION 2.—*Retention of Calculus or Fragment in
Bladder*

If during convalescence it should be discovered that a calculus or a fragment of one has remained unextracted, it will if small often pass away spontaneously, or can be washed out of the bladder

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through the wound. When too large for this, the best course of proceeding is to follow the advice of Sir H. Thompson:—"If the calculus is found to be one of medium, or inclining to large size, it will probably be wise to place the patient again on the table, dilate the wound, and remove the foreign body with the forceps: if inclining to small size it may be crushed through the urethra. On the other hand, if the patient is not in a promising condition, he must be left for the present, unless the presence of the calculus is manifestly occasioning so much distress as to render it probable that his improvement may rather be facilitated than diminished by interference for its removal."

SECTION 3.—*Pelvic Cellulitis*

Pelvic cellulitis from
infiltration of urine.
Prognosis.

Pelvic cellulitis from infiltration of urine is much the most frequent cause of death after lithotomy.

Cause.

Of the two forms of cellulitis from infiltration of urine, the more common and fatal form is that in which the cellular tissue of the pelvis primarily, and the subperitoneal cellular tissue secondarily, are affected either from division of the capsule of the prostate in making the internal incision, or from laceration of it by the use of

mechanical violence in the extraction of the calculus. In either case the urine becomes extravasated into the cellular tissue of the pelvis setting up inflammation, resulting in purulent infiltration, sloughing, or gangrene, and ending in pyæmia.

The other species is well described by Mr Coulson, who says that, though slower in its effects, it is almost equally fatal. In this the urine is infiltrated into the tissues about the rectum, and those surrounding the external incision: this effect is produced by anything which prevents the free discharge of the urine through the wound, such as the external incision having been made too small and not sufficiently sloping obliquely downwards from the prostate; an insufficient division of the anterior fibres of the levator ani; the external wound not having been made in the same direction as the internal one, so as to form with the latter a uniformly straight outlet for the urine; and lastly laceration of the walls of the incision in the extraction of the stone.

The progress of the first or pelvic form of Symptoms of pelvic cellulitis. cellulitis is very rapid, the inflammation being erysipelatous, spreading, and causing destructive sloughing of the cellular tissue. The symptoms may occasionally be insidious, but all or most of the following will be observed more or less well

marked in every case :—From the moment of the completion of the operation the patient wears an anxious expression of countenance, and instead of the relief which is at this time experienced in favorable cases, he complains of pain about the neck of the bladder with tenderness on pressure in the left hypogastrium, and suffers from great oppression of the system; no reaction takes place; the pulse becomes rapid and intermittent; the tongue dry; the hypogastric region swelled; there is complete distaste for food; vomiting usually comes on; delirium ensues, and the patient lies in a state of utter prostration, with occasional hiccough, until death closes the scene: this generally occurs about the fourth or fifth day after the operation; but now and then within the short space of forty-eight hours. At other times the course of the disease is not so rapid. Rigors are felt, and the fever has at first more of an irritative than typhoid character; but, after the lapse of twenty-four or forty-eight hours, the characteristic symptoms supervene, and the patient eventually succumbs.

In the second form, that in which the infiltration of urine takes place into the tissues about the external wound, the effects, though slower, gradually cause sloughing and gangrene of a destructive character.

Along with the general symptoms of cellulitis,

the track of the wound becomes discoloured, sloughy, and disorganised, giving exit to a foetid discharge, and the skin in its neighbourhood is apt to become erysipelatous, soft, or quaggy, and finally to crepitate under pressure.

The treatment of pelvic cellulitis is seldom Treatment. successful in its results. Erichsen says it "must be conducted on the ordinary principles that guide us in the management of diffuse inflammations. It is only by administering ammonia, with such a quantity of wine or brandy as the state of the system may indicate, together with such nourishment as the patient can take, that life can be preserved." Conjoined with the above remedies, bark may be given internally, and the patient placed in a hip bath two or three times a day. A gum-elastic catheter should be kept in the bladder to prevent, if possible, further extravasation of urine, and local treatment of the wound will often be advisable. In one successful case Sir B. Brodie, with a curved probe-pointed bistoury, laid the wound and rectum into one by an incision through the upper part of the wound into the rectum, continued downwards through the sphincter ani muscle. This treatment has not, I believe, been followed by other lithotomists, though Druitt recommends that, having first thoroughly opened out the wound with the finger, a similar proceeding should, if necessary,

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be adopted. Coulson, on the other hand, considering the great likelihood of its futility, says he cannot advise so severe a remedy. Gross says :—"When the infiltration is caused by the small size, ill shape, or improper direction of the wound, the defect must be remedied by the knife, to afford a free outlet to the urine."

Pelvic cellulitis from
mechanical violence.
Prognosis.

Pelvic cellulitis from mechanical violence is almost equally dangerous with that arising from infiltration of urine.

Exciting causes.

It is Sir H. Thompson's opinion that urinary extravasation is not generally the primary cause of pelvic cellulitis; but that it more commonly results from violence in the extraction of the calculus. Infiltration of urine with all its disastrous consequences, however, subsequently takes place, the connection of the neck and base of the bladder being destroyed by inflammation and sloughing.

Predisposing causes.

Mr Erichsen considers that constitutional causes strongly predispose to this accident, and that, consequently, in patients with organic disease of the kidneys or other parts, who are always especially liable to inflammation of a diffuse or erysipelatous kind, cellulitis may be produced by an amount of extracting force which would not affect a sounder constitution.

The symptoms of this form of cellulitis closely

resemble those of infiltration of urine, and the treatment must be the same.

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Symptoms and
treatment.

SECTION 4.—*Wound of Rectum*

Wound of the rectum, though not attended Effects. with danger to life, should be carefully avoided, for although in children, and in healthy adults with a moderate-sized wound, the injured part will generally heal with the cicatrisation of the perineal wound, yet when the wound is large and situated high up the rectum, recto-vesical fistula of an obstinate nature is likely to result.

In ordinary cases, and by the use of the precau- Cause and means of
avoiding the accident. tions about to be mentioned, the operator will have no difficulty in avoiding the accident. He should commence the external incision at a proper height above the anus, and by the first action of the knife divide the integument down to the superficial fascia only: no greater depth than this of the *anterior part* of the wound being made at any subsequent stage of the operation. He then places his left forefinger in the rectum, both to cause it to contract and to draw it to one side, while he incises, with the edge of the knife held rather obliquely outwards, the middle and lower parts of the wound, including the fibres of the transversus perinei muscle: in dividing these

fibres much caution is necessary, as the rectum lies immediately underneath them, and at this stage of the operation is apt to bulge bladder-like into the wound, in close proximity with the edge of the scalpel. Then removing his finger from the gut and placing it in the wound to push aside and depress the rectum, he divides any resisting fibres he may meet with in the upper part of the incision, and while cutting into the membranous portion of the urethra is careful to keep the point of the knife raised towards the pubic arch, lest by inclining it forwards it should wound the bowel, which would be especially liable to this accident if enlarged.

This injury, without care, may also be inflicted whilst making the internal incision, for at the moment of incising the neck of the bladder, the patient often commences to strain violently, causing the intestines to be forced downwards to such an extent that the rectum overlaps the prostate. It is equally liable to occur in enlarging the wound after the removal, and consequently without the guidance of the staff; and lastly, in withdrawing the knife from the prostatic incision if the rectum, meanwhile, is not kept pressed aside.

At the times mentioned in the preceding paragraph, as well as whilst the incision is being made upon the staff, the rectum, which is closely

connected with the posterior wall of the prostate, is especially liable to injury if enlarged and dilated from old age, or even if considerably distended with fæces or flatus, as it then overlaps both sides of the prostate. The most likely way of avoiding the rectum, when known beforehand to be enlarged or distended, is to open the urethra from behind forwards, instead of the reverse as is usually done; but in a few cases, as when the prostate is so completely surrounded by the rectum that the ordinary division of the gland must wound the bowel, Deschamp's "mixed method" may be advisable, in which no lateral section of the prostate is made, its apex only being nicked, and the prostate and neck of the bladder dilated in a very slow and gradual manner.

A special cause of liability in children to the accident is thus referred to by Coulson:—"From the manner in which the bladder of very young children ascends into the pelvis, it is necessary to employ some caution in making the internal incision so as to avoid the gut. Dupuytren recommends that it be directed in an imaginary line drawn from the umbilicus to the tuberosity of the ischium." Though this advice is useful by bringing to mind the high position of the child's bladder and the sudden curve upwards which the urethra consequently makes to reach it, yet a better means of avoiding the rectum is, I think,

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to pass the knife along the groove cautiously (the point being kept up enough to prevent slipping), as parallel as possible with the staff, so that no great angle may form between them.

Lastly, the rectum may be torn if violence be used during extraction of a large or rough calculus.

The part of the gut wounded will differ, according as the accident has occurred in making the external or the internal incision; if the latter, the wound will, Gross says, generally be found in that portion of the rectum which lies just in front of the neck of the bladder.

Treatment.

In ordinary cases, the only treatment needed is to restrict the patient to fluids and prevent the action of the bowels for five or six days, when the wound in a healthy constitution will granulate and heal up from the bottom. At other times further treatment is called for, and then that recommended by Dr Gross may be adopted:—
“The treatment consists in preventing the bowels from acting, except every third or fourth day, by means of anodynes, in washing out the rectum frequently with cold water, in permitting none but the most bland food, in enjoining strict recumbency, in the constant retention of the catheter, and in touching the edges of the wound every third or fourth day very gently with solid nitrate

of silver, or a weak solution of the acid nitrate of mercury. Chronic cases should be managed upon the same principles as harelip, that is, the edges of the fistula should be refreshed with the knife, and carefully united with wire sutures. When access to the bowel is rendered difficult, the best plan is to divide the sphincter muscle of the anus immediately in front of the coccyx. Sometimes a cure may be effected by means of the actual cautery. When the fissure is situated at the neck of the bladder, or at the junction of the bladder and urethra, it may be necessary to lay these parts and the bowel freely open with the knife, as in the common operation for anal fistula." Mr Erichsen thinks that the sphincter will have to be divided from the opening downwards, so as to lay the gut and wound into one cavity when the latter is situated high up the rectum, and is extensive; yet even in such cases Sir H. Thompson and some other authorities are of opinion that the best plan is to leave the parts untouched until the necessity for interference becomes plain from the non-cicatrization of the wound. This course of practice is the one Mr Bryant advocates even when the walls of the rectum have sloughed from injury sustained during the extraction of a large stone, the case usually doing well, he says, if left to nature. A contrary opinion is held by Poland, who, writing

in Holmes' 'Surgery' about a wound which had resulted from sloughing of the rectum, says :—
“A natural cure cannot readily take place. The earlier the sphincter is divided as for cure of complete fistula in ano, the better will be the patient's chance of being freed from an annoyance.”

CHAPTER XIII

DISEASES WHICH CAUSE DEATH AFTER LITHOTOMY, WITH SOME ACCOUNT OF THEIR TREATMENT

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MR LANE, in his edition of Cooper's dictionary, says that to four causes, viz. "shock, hæmorrhage, urinary infiltration, and pyæmia, must be attributed the immense majority of deaths:" and this statement is, I think, a fairly correct one if applied to both adults and children taken together, though the relative frequency of the various causes of death would be different in those two classes of patients considered separately. The following arrangement, founded to a great extent on that of Sir H. Thompson's, gives an approximation to the truth with respect to the diseases which most commonly cause death in the *adult*.

1. *Inflammation of the cellular tissue of the neck,* In adults.
sides, and base of the bladder is by far the most Extra-vesical cellulitis.
frequent cause of death: a strong predisposition to it existing in many patients, prior to the

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operation, in pyelitis, granular degeneration, or other diseased state of their kidneys, which renders them liable to the occurrence of low and diffuse inflammation.

Inflammation of the
mucous membrane of
the bladder.

2. *Inflammation of the mucous membrane of the bladder* is the next most frequent cause of death, not so much on its own account as from the inflammation it leads to in other organs closely connected with it. Cystitis, however, Erichsen says, may come on, about the third or fourth day after the operation, so acute as to be attended by a large secretion of viscid mucus with tenderness on pressure of the hypogastrium; but that it is rare. The treatment he recommends, consists of leeches applied on the hypogastrium, an abundant supply of diluents, and injections of tepid water through the wound into the bladder. Hot fomentations and poultices should be applied to the hypogastrium and perineum, and liberal doses of morphia are sometimes given.

The diseases resulting from cystitis are :

A. *Nephritis*, the symptoms of which are fever (preceded by rigors), vomiting, great pain, suppression of urine, and coma, succeeded by death in some cases within forty-eight hours of the attack. The treatment recommended by Thompson is “an early single cupping over the kidneys, followed by hot and stimulating applications to the loins.”

B. *Peritonitis*, also a result of the extension of the vesical inflammation : but as compared with the last-mentioned disease, this one, Thompson writes, “is often more gradual and insidious in its progress, tenderness in the hypogastrium, and a little fulness first exciting attention, the usual signs of low peritonitis following in their order. Among cases of this order perhaps are found the very few examples of recovery which take place after peritonitis. With counter-irritation and hot applications externally, and opium internally, with nutritious support and stimulant, here and there a patient survives.”

3. *Pyæmia*, resulting from absorption into the Pyæmia. circulation of deleterious substances derived from the urine, takes the third place as a cause of death in the adult. The symptoms, which may come on as early as the second or third day after the operation, are usually violent rigors, copious sweats, intense prostration, and diminished secretion of the kidneys, followed by secondary deposits of pus in the joints and viscera, death commonly resulting in less than a week. The treatment, which is, however, almost always unsuccessful, must be supporting and stimulating.

A. *Phlebitis*.—This is so intimately connected in its causes with pyæmia that I have made it a suborder of that disease. It depends upon inflammation of the veins which are abundant

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about the neck of the bladder and prostate, and is especially liable to occur if the same disease is prevalent in the hospital at the time of the operation. Persons of advanced age are the most liable to the attack, which is often unexpected, taking place after the lapse of a week or fortnight, sometimes even later, when recovery is hopefully anticipated. The only symptoms indicating this state may be slight rigor, fever, quick pulse and a feeling of nausea.

Shock.

4. *Shock*.—Adults are not nearly so liable to this cause of death as children are; though they also may succumb to it, when extremely exhausted from disease or from the feebleness of age, or if the operation is improperly performed. The last-mentioned cause comes into action when the operation is very much prolonged, or when violence is used in the extraction of the calculus, as shown by Mr Syme:—"If from the inadequate size of the wound in the bladder or *levator ani*, the stone, instead of being gently extricated, is dragged out by force, after long and painful ineffectual attempts to drag it through, the stoutest individual may suffer a shock too great for his strength, and die in the course of a few hours." The shock to the nervous system is, under these circumstances, such that it is unable to give the heart sufficient nervous force to keep up its action. Mr Coulson mentions two varie-

ties of shock differing from the form usually met with:—"The effect of the shock to the nervous system may be rather irritative than depressing. Though much less dangerous than severe prostration or sinking, this is a very troublesome state. It bears much resemblance to the one met with after lithotripsy. Sometimes the irritation manifests itself by a severe attack of delirium, unaccompanied by prostration. This is a dangerous form. In other cases, the patient is seized with shivering soon after the operation, becomes extremely restless, wanders at night, and if the state continues, falls into a condition very analogous to that denominated irritative fever; perfect rest, with the use of anodynes and gentle stimulants, are the best remedies in such cases."

5. *Hæmorrhage*, which takes the next rank, has Hæmorrhage. been fully considered in a preceding chapter.

6. When either *nephritis*, *pyelitis*, or *suppuration of the kidney* exists prior to the operation, though as already stated generally proving fatal through the supervention of extra-vesical cellulitis, it may itself be the immediate cause of death, lithotomy hastening this result by giving a spur to the disease. Nephritis, &c.

7. *Irritation of a diseased thickened bladder* is Diseased and thickened bladder. mentioned in Cooper's surgical dictionary as an occasional cause of death in old men: the patients had not the acute symptoms of peritonitis; but

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complained of uneasiness, rather than pain, in the lower part of the pelvis, generally lingering for two or three weeks. Olate clysters and blistering the hypogastrium are recommended as the best treatment.

Suppression of urine.

8. *Suppression of urine*, though usually a symptom only of organic disease, and therefore not an independent cause of death, was observed by Mr Spence in one case—that of an old stout man who died sixty hours after the operation—to occur without any appearance of structural change in the kidneys. “Were I to meet,” he writes, “with a similar case, I should lose no time, however slight the general symptoms, in using the vapour bath and other means to induce free diaphoresis as well as employing powerful counter-irritation over the lumbar region.” Dr Gross, the American surgeon, says quinine and strychnia may also be tried.

Tetanus.

9. *Tetanus* is a cause of death which has been met with in India. Brett, in his work on surgery in India, speaks of two patients having died of it, and says that a third, a child, was attacked with the same disease, but recovered. The deaths occurred in May, when, the hot winds having subsided, easterly ones prevailed, the heat being suffocatingly great, and he thinks that season is unfavorable for operating in India.

10. *Wound of the posterior part of the blad-*

der is an uncommon accident and cause of death. The mode of its occurrence is described in the chapter on lithotomy in children, in whom it is more liable to happen than in adults.

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Wound of bladder.

11. *Missing the urethra*, which, of course, ought never to occur, has, however, taken place and proved fatal. Mr Erichsen describes it as having happened to a skilful operator, who, instead of penetrating the membranous portion of the urethra, opened up the bladder beyond the prostate. “Missing the urethra altogether, and opening up the bladder through, or even altogether beyond the prostate,” he says, “is an accident which may happen if the surgeon miscalculate the depth of the perineum, and, keeping the incision too low, thrust in the knife too deeply.”

Missing the urethra.

12. *Laceration of the bladder*, though included among the causes of death, must, together with the two preceding, be set down to the account of the surgeon, not to the operation. The hypertrophied and contracted condition of the bladder renders it the most liable to laceration. Coulson writes :—“In a case of this kind, if the forceps be hastily introduced, and forcibly expanded in the bladder, this organ may be lacerated.”

Laceration of bladder.

13. *Explosion of pre-existing disease*, though arranged in the last place, is a very important

Explosion of pre-existing disease.

cause of death. Gross has well described it :—
 “Stone, as is well known, frequently coexists with other diseases, which, whether latent or open, often acquire new intensity on the removal of the vesical irritation. The organs most likely to suffer in this manner are the kidneys, bowels, brain, heart, and lungs. In old subjects death occasionally occurs during the progress of the cure from apoplexy.”

Death ratio.

Sir H. Thompson has founded statistics on 1827 cases, half of whom were children, operated upon before the introduction of lithotritry. The ratio of deaths was one in 7·977 cases : excluding the patients below sixteen years of age, it was rather more than one in five cases.

Mr Coulson's statistics are more extensive and not quite so favorable as the above. He gives a sum-total of 6369 operations (the proportion of children is not stated), most of them performed before the introduction of lithotritry, the death ratio being one in 6·62 cases. The latter author writes :—
 —“The mortality increases at each successive period. Thus, below 10 years of age it is one in thirteen, and thence gradually augments from 10 to 80 years to one in nine, one in six, one in five, one in four, one in 3·65, one in 3·23, one in 2·71.”

My statistics are founded on 300* cases of

* My total number of operations was 364 ; but of 64 I find, on

lithotomy (299 left lateral operations and 1 bilateral operation) performed by myself in India, where lithotrity is almost unknown; of these, 191 were in children. The ratio of deaths was 1 in 12 cases of adults and children collectively: of the former, it was 1 in 6·05: of the latter, below 16 years of age, it was 1 in 27·29 cases.

The result of lithotomy is more influenced by the size of the calculus than by any other circumstance, the mortality increasing in nearly the same ratio as the weight of the stone: in a table published by the late Mr Crosse, it is shown that when the weight of the calculus was from three to four ounces as many as 7 deaths occurred in 11 cases, and when from four to five ounces 3 out of 5 cases died; the ratio being 1—1·57 and 1—1·66 respectively.

The marked difference in the causes of death in childhood from those in the adult is due to cellulitis being rare in the former, while peritonitis and shock are much more common. Further particulars about the disease and the death ratio in children will be found in the chapter devoted to lithotomy in the young.

looking over my notes, that I have not been furnished with particulars of the result; but I feel convinced that the statistics of them would be equally favorable with the above. These omissions, which I regret, I account for from change of station, absence on furlough, and other accidental circumstances.

CHAPTER XIV

RECTO-VESICAL OPERATION

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Circumstances necessitating this operation.

THE most common reason calling for the performance of this operation is when the lateral method is found to be impracticable on account of the very large size of the stone. Other causes rendering the lateral operation inapplicable, and therefore generally necessitating this one, or, in a few exceptional cases, the suprapubic method, are mentioned by Coulson:—"It may be impossible to introduce a grooved staff into the bladder; it may be impossible to separate the patient's legs and place him in a proper posture. This sometimes arises from contraction of the muscles after paralysis or rheumatism. The perineum may be obstructed by tumours, &c., or the outlet of the pelvis may be so contracted or deformed, that the extraction of a calculus by the lateral method becomes impracticable."

Opinions of authorities.

Mr Spence's views.

Mr Spence in his 'Surgery' speaks favorably of this operation as a means of saving life:—"The

other form of mesial operation—the recto-vesical—is one which has been practised principally in Italy apparently with success as regards safety to life; but it is so obviously liable to risk of being followed by recto-vesical fistula that it is not likely to be adopted except in special cases, to enable us to extract a large calculus through the widest part of the outlet of the pelvis, or where, as happened in one of Mr Liston's cases, a portion of a large stone is sacculated and fixed between the bladder and rectum." After describing the mode of performing the operation, he observes:—"I should undoubtedly prefer it to the high operation for the extraction of large calculi. . . . The results in regard to safety of life, and even to the healing of the recto-vesical wound, are more satisfactory than we might have expected."

Mr Coulson considers it to be less dangerous Mr Coulson. than the suprapubic operation. He says that the only serious objection which has been advanced to its performance in suitable cases is its liability to be followed by incurable fistula, yet this has he thinks been overrated, for, according to the statistics of the operation, it has not been found to happen oftener than once in every five cases. He also gives it as his opinion that it is less dangerous than breaking up a large and resisting calculus in a diseased bladder would be,

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and says that Bell asserted that not one patient among ten escapes under such circumstances.

Sir B. Brodie.

Sir B. Brodie recommends this operation for the extraction of calculi of great bulk, and remarks that “although the incision of the neck of the bladder extends beyond the boundaries of the prostate, the ill consequences arising from the escape of urine into the cellular membrane are likely to be in great measure obviated in consequence of the free opening which has been made into the *rectum*.”

Chelius.

Chelius speaks decidedly in favour of it, preferring it to the high operation for the extraction of calculi too large for the lateral or bilateral method. He particularly mentions as one of its advantages the comparative safety to life, and, in the words quoted below, meets the objection put forward by the opponents of the operation that the entrance of fæcal matter into the bladder is a common accident:—“The entrance of fæcal matter into the bladder can only happen by cutting through its base, and not by Vacca’s proceeding (incising the prostate, &c.), as it is prevented by the valve-like protrusion of the wall of the bladder cut into below, and still more as the excrement, in consequence of the division of the *sphincter*, meets with less obstruction from the natural passage.”

Mr Poland in ‘Holmes’s Surgery’ speaks dis-

paragingly of it:—"The drawbacks to the operation are the gliding of the mucous membrane before the knife, the great risk of wounding the peritoneum and vesiculæ seminales, the subsequent occurrence of urinary infiltration, the passage of fæces into the bladder, fistulous sinuses, &c. Of 185 cases operated upon, 38 died, being 1 in 4·86; but the subsequent condition of those who recovered is not stated."

Dr Gross, an American authority, writes very unfavorably of it "on account of its liability to be followed by extensive suppuration of the cellular tissue within the pelvis, injury of the ejaculatory ducts and seminal vesicles, and lastly, though not least, stercoraceous fistule, difficult, if not impossible, of cure." He relates, as quoted below, a modification of the operation in which the neck of the bladder does not appear to have been incised, and which ended most successfully:—"In a case operated upon in 1860 by Dr Noyes, the wound, made through the central portion of the prostate, and enlarged bilaterally, was closed with six metallic suturês, supported by a leaden button. The apparatus was removed on the twelfth day, the parts having entirely healed, except at one little point, which afterwards cicatrized under the application of nitrate of silver."

Mr Lane, in his edition of 'Cooper's Dictionary,' points out the especial danger there is in this

operation of wounding the peritoneum, on account of the way it projects forward from between the point of the entrance of the ureters, so as to form a *cul-de-sac*. “In an empty bladder this fold approaches in the median line to the posterior border of the prostate, and in most persons the bladder must be greatly distended to carry the line of reflection backwards more than an inch from this point. A longitudinal incision cannot therefore be made to the extent of one inch in this part of the bladder without a risk of wounding the peritoneum; and the risk is enhanced in cases where the bladder is irritable, and resents the presence of more than a small quantity of urine, or where it is thickened by chronic inflammation and hypertrophy of the muscular coat—conditions very likely to be present when a stone has been lodged for any length of time in the bladder.” The same author says that Dr Marion Sims was successful in closing the wound with silver-wire sutures in a case operated upon by the recto-vesical method behind the prostate. “The patient,” he says, “was placed on his left side, and Dr Sims’s speculum was introduced into the rectum, exposing the anterior wall of the rectum, just as it would the vagina of the female. . . . The wires were removed on the eighth day.”

In the recto-vesical operation, as performed in

the present day, the incisions are made completely through the neck of the bladder and the *lower surface of the prostate gland from base to apex*, and with this advantage that there is less risk of wounding the peritoneum than in the original operation, in which the lower fundus of the bladder only was opened beyond the base of the prostate, without any incision of the gland.

The best method of performing the operation is thus described by Thompson:—"The patient is placed in the usual position, and a large staff with a median groove held firmly in the middle line. Taking a strong straight sharp-pointed bistoury in his right hand, the operator introduces it flat on the palmar surface of his left forefinger into the rectum, and feels with its tip the line of the staff. When about an inch and a half or an inch and three quarters of the blade are concealed within the bowel, with the right hand he raises its edge, and carries the knife upward to the groove in the staff, propelling the blade at the same time with the left forefinger. He then divides, at this first incision, the upper wall of the rectum, the sphincter ani, and the integument and subjacent tissues for about an inch in the middle line of the perineum.* He

* The division of the integument of the perineum with the sphincter ani is accomplished by the surgeon passing the point of the knife through the integuments in the situation of the staff,

should reach the groove of the staff in this first incision, and having done so, he next directs the nail of the left forefinger, so as to enter the groove near to the membranous urethra, and guide the point of the bistoury into it there, the edge being now downwards. Having securely placed it in the groove, he pushes the blade from him along the staff directed by the left forefinger, dividing the prostate and neck of the bladder so as to reach the trigone. The exact extent of this incision must depend on the size of the stone, and, as it may be presumed that this method should be employed only when the stone is unusually large, the incisions must of course be free. In no case, however, is it permissible to place in danger the peritoneal pouch, which limits the posterior border of the trigone. The finger can now easily examine the stone and guide the forceps in the extraction. The wound is favorably placed as an outlet for all discharges, and no hæmorrhage need be feared."

Mr Spence's directions for the performance of this operation are very similar, but he adds that, after the knife has been run along the groove of the staff into the bladder, the surgeon "introduces the forefinger of his left hand into the rectum, above the base of the prostate, to guide

and then withdrawing the knife towards himself through the whole of the perineum and sphincter.

the knife, he depresses its point, so as to puncture the bladder immediately above the base of the prostate, and then placing his left forefinger so as to press on the projected point of the knife, he carries it down, dividing the anterior wall of the rectum, prostate," &c.

After the removal of the staff, if it should be thought necessary to enlarge the incision, it can be done by a button-headed bistoury introduced on the left forefinger.

Measures must be taken for keeping the bladder constantly empty by means of a catheter, so that the cut surfaces may not be irritated by the contact of urine; and Chelius writes that the cure will be promoted if, after suppuration is established, caustic is applied to the wound; the edges of which must be drawn slightly asunder and touched by means of passing up the rectum a canula having a piece of caustic fixed in it. After-treatment.

If a fistula should form, it may be touched with the caustic in the manner just recommended, or with a red-hot wire introduced through the speculum ani. Recto-vesical fistula.

Sir H. Thompson, in his 'Clinical Lectures on Diseases of the Urinary Organs,' has made some useful suggestions on the subject of recto-vesical fistula. He says:—"I cured one case by position. . . . It occurred to me, after some wholly inadequate treatment by other means, to

tell him to lie down on his face and make water in that position, never allowing a drop of urine to pass in any other way. In a few weeks he was quite cured. . . . I take it that I should now have made that man pass the catheter into his bladder and draw off every drop of water ; and I have no doubt it would have been successful. Unless there is a loss of substance, that usually does cure the patient ; but if there is a loss of substance, and worse still, if the opening is from the bladder into the rectum direct, then nothing is left but to examine the place thoroughly in the first instance. Put the patient on his back, as for lithotomy, and introduce a duck-bill vaginal speculum, as you have seen me do, so as to get a good light thrown upon it. If it is sufficiently large to do a plastic operation, I should not hesitate to perform the same operation that is done for openings between the bladder and vagina—that is, to pare the edges, and stitch them together with silver sutures—only it is more difficult, as there is less room in the rectum for manipulating than in the vagina. . . . I believe that is the best plan when these cases occur with loss of substance. If the opening, however, is very small, it may be greatly diminished in size, if not closed, by applications of the galvanic cautery.” He describes a case in which this treatment was applied with partial

success : it was that of a lad in whom the condition happened after the operation of lithotomy : —“ I placed him in the lithotomy condition under chloroform ; emptied the bladder by a catheter ; and with the vaginal speculum above mentioned, we could all see the opening in the upper and left part of the bowel, which admitted a No. 9 silver catheter. Having ready prepared a large double wire connected with a powerful battery, the wire was first shaped and placed within the fistulous canal, and then, the current being turned on, the sides were freely touched with the heated wire. This proceeding was repeated about once a week or ten days, the quantity of urine passed by rectum rapidly diminishing.”

I am of opinion that the recto-vesical operation is the best method of extracting the calculus when it cannot be removed safely through the perineum. Four out of the seven authors, quoted above, also approve of it ; while the remaining three, though stating certain dangers incident to it, do not propose any better substitute.

The frequency of incurable recto-vesical fistula after this operation renders it a less satisfactory method than it would be if such a result could be avoided. Whether it would be prudent at once to close the wound with Dr Marion Sims' method of sutures, with the object of obtaining

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immediate union, I will not venture to express an opinion, as I feel doubtful as to the advisability of diminishing by any means the freedom of the outlet for the discharges, which appears to be the especial safeguard against infiltration of urine after this operation.

Death ratio.

Coulson gives the mortality in 185 cases of the recto-vesical method, as 1 in 4·87.

CHAPTER XV

LITHOTOMY IN CHILDREN

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THE directions already given for the performance of lithotomy in adults apply equally to the operation in children; though, from the difference in the formation and development of the parts concerned in the latter, a further description of some points is given.

The pelvis during childhood is very different Anatomy. from what it becomes in after life; it is so imperfectly developed that the bladder is not contained within it, but becomes one of the floating viscera of the abdominal cavity. The measurement of the inferior outlet of the pelvis is very variable in children. Mr Butcher, of Dublin, says: —“Velpéau measured forty subjects, and observed in one case these processes” (*tubera ischii*) “to be but one inch and three quarters asunder, while in another they were four inches apart.” In the child the only part of the bladder in the pelvis is its neck, which is narrow and tapers into the urethra: its axis is very variable,

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sometimes even nearly vertical. The bladder being therefore chiefly an abdominal viscus is wanting in support and steadiness: the urethra is very weak, its structure being extremely soft, yielding and readily torn asunder by violence.

Injection into bladder
before operation.

An injection of tepid water into the bladder of a child before the operation is very useful, by bringing it lower down and steadying it: it is also, when containing fluid, less liable than an empty one to injury from the point of the scalpel if accidentally thrust too deeply into the organ.

Staff and its introduc-
tion.

Staffs for children should be more strongly curved than those for adults, and one ought to be chosen so small as not completely to fill up the neck of the bladder, otherwise after incision the introduction of the finger may be a matter of difficulty, particularly in very little boys.

On account of the above-mentioned feeble condition of the urethra in children, the staff may make a false passage between the bladder and rectum, as described below, or may penetrate the upper wall of the urethra in front of the bladder.

With especial reference to the former accident, Sir H. Thompson says, "the staff is liable, if undue force be used, to be pushed through the walls of the urethra, commonly at some point in

its floor below the pubic arch, and thus to find its way below the bladder, between it and the rectum, where the mobility of the instrument, permitted by the laxness of the cellular connections there, may lead the operator to believe that its point is in the bladder itself. The same thing may happen in the adult; but from the cause stated, co-existing with the sharp curve upwards of the urethra in this situation in the child, it more readily happens in the latter. . . . There is one great rule which, as far as I know, is the only absolute safeguard against the performance of an operation on a staff which has not passed into the bladder; and it is, *to require clear, audible, or tactile proof of contact between the stone and the staff on which the patient is to be cut.*" The importance of this rule as a means of avoiding false passage, and the diagnosis and treatment of the accident when it has occurred, are fully treated of at page 141.

Thompson says that another danger which Rupture of urethra. arises from the soft and lax state of the tissues in children "is the facility with which the membranous urethra may be separated from the prostate. . . . The accident may occur in two ways:—The operator may, through fear of having his deep incision too free, make a section of the urethra and prostate insufficient to admit the tip of the finger, and in attempting to dilate

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the opening instead of incising afresh, the catastrophe occurs. Or, from this insufficient incision, as Dr Murray Humphrey points out, the forefinger of the surgeon may, in failing to enter the bladder, make a kind of cavity between the bladder and rectum, and he may believe that he is in the first-named cavity. He may pass the forceps into this, and even feel the stone, thinly covered by the coats of the bladder, and attempt extraction. But, secondly, in the act of opening the membranous urethra, he may lose his hold upon it with the nail of the left index finger, and repeat his incision once or even twice before he fairly gets his knife into the groove of the staff, and runs it on towards the bladder. The urethra meantime may have shifted its position slightly, and three or four adjacent separate notches have been made into it. If only a small amount of force be employed in the subsequent attempt to pass the finger into the urethra, its separation from the prostate may also take place. . . . The remedy, when this accident has occurred, is first to ascertain that the point of the staff is still in the bladder, and then to make a free incision of the prostate with a sharp knife—for these soft tissues are not easy to cut, and require both point and edge for a perfect section—so that the finger may be introduced into the cavity.”

Procedure in case of
ruptured urethra.

The external incision is commenced from five

lines to one inch above the anus, according to the age of the patient, and, on account of the shallowness of the perineum, is, in general, more quickly and easily performed than in adults.

Since it is necessary to use a small staff with a comparatively shallow groove, the operator must be careful to cut into and not to one side of it; but this will present no real difficulty if Butcher's directions, quoted at p. 149, are attended to.

Cutting into the urethra.

At the same place will also be found good advice by that author on the mode of making the internal incision. Scarpa recommended an incision through the prostate of two lines only, which he thought, from the great extensibility of the parts in a child, was sufficient for the extraction of a stone of ordinary size. Thompson appears to be an advocate for a greater freedom of incision than this; he says:—"The deep incision through the urethra and prostate should be made with clearness and decision, and with sufficient freedom to admit the tip of the operator's index finger with tolerable ease, otherwise he may drive the neck of the bladder along the staff, or slide the finger into the cellular interval between the bladder and rectum." At the same time, this incision must be kept within strict bounds, as any, except a very limited one, made into the undeveloped and small bladder of young children must be fraught with danger. The prostate

Internal incision.

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Complete division of prostate.

gland being rudimentary is, however, in these cases, always, or with few exceptions, completely divided. This division of the gland takes place in all ordinary operations upon children; according to Gross, from eighteen months to ten years of age or more. It does not involve risk of infiltration of urine.

Passage of knife along the groove.

The operator, unless he remembers the more vertical direction of the prostatic portion of the urethra and of the axis of the bladder, may allow the scalpel to slip out of the groove, especially as this is shallow in the little staffs used. The depth to which the knife must be introduced before the neck can be opened by it is *comparatively* greater than in the adult, on account of the child's bladder being situated higher in the pelvis. The little bladder of a child, should it become empty of fluid with its walls closely enveloping the stone and end of the staff, being very liable to injury, the operator must not enter the knife into it more deeply than just to notch its neck, and must be especially careful not to allow it to plunge forward beyond the end of the staff.

Introduction of the finger and forceps.

It is of much importance that the operator should insert at least the tip of his finger into the neck of the bladder before the staff is withdrawn, for, otherwise, on the removal of the instrument, he may not be able to discover the opening of the vesical cavity, and in searching for it among the

lax tissues of a little child, his finger may go astray and penetrate the cellular tissue below the bladder. This, or some other accident which led to the operator's failing to reach the bladder, has been, in Sir William Fergusson's opinion, the cause that after completion of the internal incision the surgeon has, in some cases, been unable to find the calculus. The same author, in order to assist others in recognising the vesical opening, writes, with regard to one case in which he met with difficulty:—"I knew that I had never crossed that narrow neck which is always felt as the finger passes into the bladder when a limited incision is made."

Failure of finger to enter the bladder.

In reference to the question—How can the danger of missing the bladder be avoided?—he says: "My answer is, that more care than is usually given should be devoted to the operation, and that as the surgeon cuts into the membranous portion of the urethra and neck of the bladder, he should never push the point of his forefinger onwards unless he feels certain that he has it between the staff and the wound." Though not written in reply to the above question, the following directions by Thompson and Humphrey, if carried out, will diminish the chance of missing the bladder. Thompson writes: "The finger and forceps should be kept well up behind the symphysis in their transit, in consequence

Means of avoiding the accident of missing the bladder.

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of the high situation of the bladder, which in very young children lies, when distended, as much in the abdomen as in the pelvis." Humphrey's advice is:—"The young operator should be content to go slowly on, not to be seduced into quitting the guidance of the staff, not on any account to withdraw the staff till he is certain that his finger is in the bladder, and till he feels the stone with it, but to work quietly and gradually on with the finger and knife till he has brought the finger into contact with the stone."

Difficulty of introducing the finger.

The want of pelvic support for the bladder and its consequent unsteadiness and recession before the finger during the endeavour to introduce it into its cavity are peculiar to the operation in children. This difficulty of entrance is especially met with in young boys with stone so small as not to have caused dilatation of the neck of the bladder, and, as a rule, the smaller the patient the more difficult will be the insertion of the finger. In these cases it may be possible to insert the little finger, if the index finger fails to effect an entrance; and assistance in all such efforts will be derived from having the hypogastric region pressed down upon so as to steady the bladder. Entrance of the finger has occasionally been accomplished by the manœuvre of twisting it round the staff to the right side of the

vesical neck, while the instrument was pressed towards the left. In all cases it has not been found necessary to pass the finger fully into the little neck ; but the tip only being introduced, and the parts somewhat dilated, a pair of forceps of smaller diameter than the finger have been inserted.

If the surgeon fails in readily introducing his finger, he must on no account forcibly and roughly try to push it in, lest he drive the neck of the bladder upwards and separate it from the urethra, which in the child is easily lacerated. As the difficulty is sometimes due to the neck of the bladder not having been fairly opened by the internal incision, the surgeon should, in this case, again pass the knife along the staff into the neck, so as to extend the incision a little. If a second incision is not thought advisable, he should dilate the one already made, and this is best done by means of a common polypus forceps (the kind without a dilated end should be used) passed closed along the groove of the staff into the neck of the bladder, the surgeon being careful to enter them fully into it, and not, by mistake, into the prostatic urethra only ; they are then gently opened so as slightly to stretch and dilate the internal incision together with the vesical neck.

Second incision of neck sometimes required.

When once insertion of the finger has been effected, there is, in general, plenty of room for

Introduction of forceps.

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the introduction of the forceps; in the event of any little obstruction being met with, the part should be further dilated with the finger, or an attempt made to introduce a smaller pair of forceps. They must, however, be passed with much care, for, on account of the laxness and softness of the parts in children, the readiness with which the forceps may slip between the bladder and rectum cannot be too strongly impressed on the young operator.

After-treatment.

When the child is very unruly or restless either immediately after the operation or at any later period, it is advisable to tie his legs together lest the wound be disturbed.

It is important that children should be kept in the horizontal position until the wound has healed, it having been observed that, from a neglect of this rule, partial incontinence of urine is particularly apt to occur in them.

Earlier support is required for children than for adults.

Prognosis.
Favorable
circumstances.

The causes which render the operation so much less fatal in the child than in the adult are said by Sir H. Thompson to be threefold:—First. The sexual apparatus is in a rudimentary condition, and consequently injury of it does not involve the constitutional shock which it does in the adult, in whom it is associated through the cerebro-spinal system by the closest ties with all the other

vital forces of the economy. Secondly. "The processes of growth, and consequently of repair, are more vigorous during childhood than during any other term of life, and injuries are more rapidly and more easily surmounted than when those processes are less active. . . . Thirdly. The position of the bladder in children favours the continuous and complete discharge of urine and of all noxious secretions after operation." Mr Erichsen thinks the chief cause of the great comparative success to be, that "the urine is less irritating, less loaded with effete materials of an unhealthy character, and consequently less apt to excite inflammation in those textures over which it filtrates in its passage through the wound." To the above, I think, should be added that the complication of disease of the kidneys, which exerts a more unfavorable effect than any other circumstance, is rarely present in children.

Up to the end of the fourth year of life lithotomy is much less successful than during any other period of childhood, the principal reason being the dangers resulting from the first dentition and from the feebleness of infancy.

Unfavorable
circumstances.

The diseases which cause death in children after lithotomy are widely different from those in adults. Pelvic cellulitis is rare, but peritonitis, which is not frequent in the adult, is in them the most common disease, being readily excited, through the

Peritonitis.

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intimate connections the peritoneum has with the bladder in the child, if the latter be inflamed by rough manipulations of the forceps or other instrument within its cavity, or by force in removing the calculus. Their close proximity also renders the peritoneum liable to be involved by too large a section of the neck and base of the bladder.

Treatment of
peritonitis.

The treatment generally consists in the use of antiphlogistic measures, modified, however, according to the constitution, which is apt to be very delicate in the calculous patient. Constant fomentations and poultices, with the internal administration of Dover's and grey powders, and, in a few cases, the application of leeches, have proved beneficial. With the above-mentioned modification, all the principles of treatment are the same as in ordinary cases of primary peritonitis.

Exhaustion.

Exhaustion ranks next to the above in frequency, as a complication during the after-treatment in children. A child who had long been a sufferer from calculus is usually in a state of sad weakness, and may, without any further cause of exhaustion, never rally after the operation; if to this be also added the shock of a prolonged operation or that of loss of blood (the latter being always badly tolerated by a young child), he will generally quickly sink, life perhaps being terminated by convulsions.

Sir H. Thompson has collected together the statistics of the death ratio of 1827 cases before the introduction of lithotrity, and finds it to be, in children under 16 years of age, 1 in $15\frac{1}{2}$ cases.

Mr Coulson's statistics of 2972 cases, most of them operated upon before lithotrity was much employed, show a mortality in children under 10 years of age, of 1 in 13 cases.

My own statistics apply to 191 children, all of them operated upon by the left lateral operation: they show a mortality of 1 in 27·29 cases.

Mr Erichsen says that when children die after lithotomy, it is generally in consequence of some preventible cause—"some accidental violence having been inflicted during the operation; such as the mistaking the recto-vesical space for the interior of the bladder, tearing across the urethra and non-extraction of the stone, wounding of the recto-vesical fold of peritoneum, or perforation of the bladder by the point of the scalpel."

CHAPTER XVI

MEDIAN OPERATION

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THOUGH I myself have nearly always preferred to practise lateral lithotomy, as affording more space and enabling me to perform the operation with more facility than I could have done by the median method, yet the latter is so strongly advocated by some eminent authorities, that I think it right to quote their opinions both as to the circumstances in which to adopt it and the best mode of performing it.

Some of the indications for the operation laid down by Mr Erichsen are as follows :

“In cases where foreign bodies, such as pieces of bougie, of tobacco-pipe, &c., are lodged in the bladder, the median is preferable, the body being small, elongated, and easily extracted.”

“It may be employed to remove stones not exceeding one inch in their smallest diameter.”

“In cases in which the patient is so anæmic that the loss of an additional ounce or two of blood might turn the scale against him, median

is preferable to lateral lithotomy. For, although it is by no means almost a bloodless operation, as is supposed by some, yet there is less hæmorrhage during the performance, or rather, perhaps, less continuous oozing after its completion, than in the lateral, and there is certainly not the danger of the profuse bleeding that is sometimes seen in that operation."

Sir H. Thompson recommends this method in stricture of the urethra with small and even medium-sized stones:—"The median operation may be selected, while its line of incision being central, may be easily made to divide also the rigid tissues of the stricture."

Mode of performing
the operation.

A good mode of performing the operation is the following:—The operator must first introduce a staff with a median groove into the bladder, and entrust it to an assistant, who, drawing it up against the under part of the symphysis pubis, must keep it strictly in the middle line. The surgeon places his left forefinger in the rectum to insure its safety, and then proceeds to make an incision (in the words of Sir H. Thompson), "in the line of the raphé from about two inches and a half above the anus, downwards as near to its margin as is safe, for you want all the space you can get. Dissecting down to the staff, with the finger in the rectum, and opening the urethra in the membranous portion or thereabouts, you

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carry a director on into the bladder; your finger follows, and dilates, and then the forceps on that." In addition to the above, it is sometimes recommended that after the knife has entered the membranous portion of the urethra, its point should be pushed towards the bladder for the extent of a few lines, so as just to incise the apex of the prostate.

Mr Erichsen recommends that the director used for the purpose of opening up the urethral canal and clearing a way for the passage of the finger should be *beaked* and shaped like a large hernia director, and he says:—"Having opened the urethra, I think it is better to dilate the prostate before withdrawing the staff: by pushing the finger slowly, with a rotatory movement, along its side, the bladder is entered with more ease and certainty, whereas if only the probe be used, it may not be stiff enough, and the surgeon is apt to push the bladder before him."

Sir H. Thompson says in his 'Clinical Lectures:'—"Manifestly this operation will not do for large stones." Median operations "answer well for small and medium-sized stones; but these are, or should be, crushed now, and we do not want any operation for such stones."

The advantage of the median over the lateral operation for the extraction of even the smaller-sized stones has always appeared to me doubtful, and I observe this author, in the same lectures,

Remarks on the
median operation.

saying that he does not find in practice that the median method is attended with less hæmorrhage than the lateral. He writes:—"I attribute this to the bulb. I regard the bulb as a large artery to all intents and purposes. You cut into that spongy tissue—not in all cases, but in some—and there is as much bleeding as if you cut the artery of the bulb, and more difficulty in controlling it. The bulb must be cut more or less in the median operation."

The above mode of performing the operation differs materially from Mr Allarton's, that surgeon applying *mechanical* dilatation to the prostate and neck of the bladder, when the finger is found insufficient for the purpose.

Sir H. Thompson says that no mechanical apparatus to effect dilatation should be employed in this operation, and that "when the deeper parts of the wound feel more than usually rigid and unyielding, or when the stone proves to be larger than was anticipated, it is advisable to make an incision in the left side in the same direction as in lateral lithotomy, but generally less extended, for the purpose of affording more space. This is accomplished after the urethra has been opened, by introducing a long straight, probe-pointed bistoury, guided by the left index finger, and made to incise as much as the operator deems necessary."

CHAPTER XVII

SUPRA-PUBIC LITHOTOMY

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—

IN the 365 cases of stone in the bladder extracted by myself, I have not had occasion to perform either this or the recto-vesical method; but judging from statistics and from my intimate acquaintance with the subject of stone in the bladder, I should prefer to adopt the recto-vesical operation for the extraction of very large stones if I ever had to choose between the two methods. Sir H. Thompson also appears, from the following quotation, while not altogether condemning the high operation, to regard the recto-vesical as the best:—"The high operation offers perhaps a good chance, if the bladder be distensible, and the patient is not corpulent. Data, however, are wanting to determine the value of this as well as of the recto-vesical operation in relation to extremely large stones. Probably the latter might be regarded as the better procedure were it not for its liability to be followed by permanent fistula."

Coulson writes disparagingly of it:—"When the bladder is much thickened, irritable, and contracted—and I have already explained that this frequently occurs when the stone is large—the bladder is situated low in the pelvis; it is difficult to make it ascend above the brim of the pelvis; the peritoneum remains applied close over the inlet, and the serous membrane runs much risk of being divided, while it is difficult to incise to a sufficient extent the anterior wall of the bladder which is concealed behind the symphysis pubis; neither forced injections nor the *sonde à dard* of Frère Come are sufficient to overcome this obstacle in a complete manner."

Under exceptional circumstances it may be the most suitable form of lithotomy—thus it may, perhaps, be the best for the extraction of a very large calculus from a patient in whom the prostate is much enlarged; and Coulson writes:—"It is said to be a valuable resource in cases where the calculus is impacted in the neck of the bladder or partially encysted in the floor of the organ behind or to the side of the prostate."

Exceptional
circumstances
indicating it.

The following method of performing the operation is Civiale's: the description is copied from Sir H. Thompson's work on 'Lithotomy':—"The patient is placed on a firm operating table of the usual height. He lies on his back, with the pelvis elevated at least four or five inches

Mode of performing
the operation by
Civiale.

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above the level of the loins and shoulders, so that the abdominal viscera shall not press on the bladder, but rather fall away backwards from it. The bladder, which should be capable of retaining a tolerably large quantity of fluid, is now to be injected to a full extent, so as to bring its apex to the upper border of the symphysis pubis, or above it. In this manner a sufficient space is obtained between the symphysis and the peritoneal investment of the anterior wall of the abdomen, where it quits it to cover the bladder. The limits of this interval admit of great extension, being filled mainly with cellular and fatty tissues of a very loose and extensible character, and this fact it is which furnishes the ground for operating in this situation. It follows, therefore, that if the bladder is not capable of considerable distension so as to rise into the interval in question, the case cannot be regarded as suitable. The surgeon now passes into the bladder the *sonde à dard*" (see fig. 43 of Thompson's 'Lithotomy,' 2nd edition), "(an instrument having very much the form, size, and appearance of a large prostatic catheter), and by depressing its handle raises the point nearly to the level of the upper border of the symphysis. It contains within it a strong stylet with a cutting point, which latter is concealed close to the apex of the sound, and lies in its concavity, whence it can be made to emerge

at the will of the operator. Having confided the *sonde à dard* to an assistant, he places himself on the patient's right side, and commences the incision above the pubes, which should be from three to four inches or more in length, according to the amount of fat at this spot, and which in some subjects is very abundant. It is to be made exactly in the median line, and at its lowest point should reach the top of the pubic symphysis. The cellular tissue and fat are divided to an equal extent, until the linea alba is exposed by its characteristic glistening appearance. Placing his left index finger on this, and verifying through it the upper border of the symphysis, he divides with the scalpel the linea alba at this point, in the median line, from a quarter to three eighths of an inch, and then introduces the bulbous extremity of the aponeurotome" (see fig. 44 of Thompson's 'Lithotomy'), "which by its form enables the tendinous structures to be incised without any risk to the parts beneath. The division is accomplished by directing the aponeurotome upwards to the extent of one and three quarters to two inches. The operator now takes the *sonde à dard* from the hands of the assistant, who has hitherto held it in its place; and with the right hand depresses its handle between the thighs of the patient, directing the point to the wound above the pubes. With his left hand he

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seeks the end, now readily to be felt through the tissues still remaining uncut, and fixes it between the thumb, index, and middle finger, taking care while doing so to remember that it is from the concave surface that the point will be protruded. Having rendered the instrument quite firm between his two hands, he directs the assistant to press the handle of the stylet so that the point issues from its place for two or three inches, and appears in the wound immediately above the symphysis. A communication with the bladder is thus perfectly established. The surgeon now takes an ordinary scalpel, and, placing it in a groove existing for that purpose in the stylet, cuts downwards from the point of transfixion nearly to the neck of the bladder behind the symphysis. His forefinger is then applied, with its palmar surface upwards, to the top of the wound, to hook up the bladder, while the assistant withdraws the *sonde à dard*, having first replaced the stylet in its sheath. An instrument called the 'Gorgeret suspenseur' (see fig. 45 of Thompson's 'Lithotomy'), "but which we may term the hooked gorget, now replaces the finger, and is committed to an assistant standing on the left side of the patient. It is very important to maintain the top of the bladder steadily in place throughout all subsequent movements, and that the peritoneum, which is quite close to the wound at this

point, should be preserved from injury. The surgeon now searches the interior of the bladder with his fingers, ascertaining the position and size of the stone, and introduces the forceps for its removal, which is generally tolerably easy, and may be effected by careful traction upwards and backwards. In a few cases, with stones of extreme size, the wound has been divided laterally to a small extent in order to afford additional space."

The above, though giving a good description of the principles to guide the surgeon in performing the operation, will often require some modifications in the details of carrying it out, as it is not probable that the operator will be provided with the special instruments used by Civiale.

Additional instructions re the operation.

On this account the following description may be useful, as Mr Erichsen performs the operation without the aid of any special instruments. He says that an ordinary catheter introduced through the urethra, and made to project above the pubes, may be used to raise up the fundus of the bladder above the pubes, and to serve as a guide to the incision into it. "The bladder having been slowly but fully injected with tepid water, so that it may rise above the pubes, an incision, about three inches in length, is to be carried from the pubes directly upwards in the mesial line. The pyramidales are to be cut across near their

Mode of performing the operation by Mr. Erichsen.

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origin, the linea alba exposed, cautiously opened near the pubes, and divided upwards some little way. The peritoneum must next be pushed back, and the dissection carefully carried through the areolar tissue above the bone, until the instrument previously introduced can be felt through the bladder, when, if it contain a sliding and pointed stylet, this may be pushed through the coats of the bladder; if not, an incision must be made down upon it, and the aperture in the organ enlarged downwards towards the neck of the bladder by means of a probe-pointed bistoury, so as to admit the fingers. The forceps must then be introduced, and the calculus extracted."

Mr Bryant mentions a point which is particularly to be attended to in performing this operation, namely, that the opening into the bladder should be made close to the *symphysis*; and he also advises that the wound in the abdominal parietes should be carefully kept open with retractors during the subsequent steps of the operation.

After-treatment.

The legs must be raised, and as the principal danger after the operation is the infiltration of urine into the subperitoneal cellular tissue, the following instructions by Erichsen should be carefully carried out, he says—"This accident may be best prevented by introducing a gum

elastic catheter into the urethra, and leaving it there for a few days until consolidation has taken place and the wound shows a disposition to close, pressure being at the same time kept up on the lips of the incision."

The danger mentioned in the subjoined extract from the same author would not occur if a proper selection of cases were made:—"Another cause of danger in this operation is wounding the peritoneum, which may occur in consequence of the contracted state of the bladder causing it to lie low in the pelvis, and thus preventing the proper introduction of instruments to carry it up above the pubes."

Wounding the
peritoneum.

The statistics are less favorable than those of any other form of lithotomy. Coulson writes that this operation in 268 cases gave a mortality of 1 in 3.08. In 104 cases collected by Humphrey, of Cambridge, the mortality was 1 in $3\frac{1}{3}$.

Statistics of death.

CHAPTER XVIII

BILATERAL OPERATION

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DIRECTIONS for the best way of incising the right side of the prostate, when it is thought that a double incision of the gland is needed, will be found at page 162, and I would only add here a suggestion, which has often occurred to my own mind, that the principle of the bilateral section of the prostate with a *unilateral* external incision is defective, and inferior to Dupuytren's bilateral external incision. The former method does not afford so much space, and there must be more risk of urinary infiltration into the textures over which the urine passes than if the external wound afforded a free and direct channel on the same plane as the internal wound, as it does in Dupuytren's operation. In a calculus with a mean circumference of $6\frac{3}{16}$ inches I adopted Dupuytren's principle with perfect success. Mr Spence also advocates it, though he gives a different reason for his preference. He says,

speaking of a case of difficulty in seizing and extracting a calculus—"As I observed when speaking of the bilateral operation of Dupuytren, I believe that method would have enabled me to reach and seize the stone more easily than I could by the lateral superficial incision, even with bilateral section of the prostate, and I should have recourse to the bilateral operation in cases of very large calculi."

The defects in Dupuytren's operation were not in its principle, but in the way its inventor carried it out. In the first place, he applied it to all cases of calculi, entirely discarding the left lateral operation, and in the next, he used a lithotome, instead of a scalpel, for dividing the prostate, the former, in my opinion, a dangerous instrument, for reasons already stated.

Defects of
Dupuytren's
operation.

The increase of space gained by the double section of the prostate is thus stated by Mr Coulson:—"The lateral incision gives an opening which allows a spheroidal body thirty-four lines in circumference to pass out; the bilateral incisions give one which admits the passage of a sphere forty-eight lines in circumference, besides the gain of dilatation on both sides instead of one."

Increase of space
obtained by bilateral
incisions.

This author points out the greater danger there is of wounding the pudic artery in bilateral section of the prostate than when the single

Hæmorrhage.

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incision only is made, because it has to be almost always done without the staff, and therefore without any sure guide to direct the incisions.

Mortality.

In 112 cases of Dupuytren's operation, Coulson says there was a mortality of one in four patients.

CHAPTER XIX

MISCELLANEOUS SUBJECTS

Prophylaxis

PROPHYLAXIS is an important subject, and should always engage the attention of the surgeon after the operation, in order to prevent a recurrence of the disorder.

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As yet no certain prophylactic treatment is known, though benefit may be derived from hygienic measures, and also, but to a less extent, from the administration of medicines.

Dr Beale's advice is as follows:—"It will often be found that the tendency to calculous disorder is explained by deranged chemical changes, which may perhaps be materially modified by attending to the action of the alimentary canal and skin, altering the mode of living, and administering the salts of the vegetable acids, alkalies, or mere diluents in large quantity, according to the nature of the case." An endeavour should be made to bring about a healthy state of the urine,

Dr Beale's advice.

Dr Prout's advice.

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which, as Dr Prout says, "is not only one of the most natural, but probably, also, one of the most powerful solvents for all the ingredients likely to exist in urinary calculi that we can hope to possess." The practical inference he draws is "that in all cases of ordinary concretion, one of the points to be attended to is to restore the healthy condition of the urine, by improving, as far as we are able, the general health, and the local condition of the urinary organs." Exercise or employment of body and mind, he especially recommends as having a good effect on the general health.

Solvents.

With reference to the practice of administering alkalies or acids in excess, with the object of dissolving the stone, the latter author gives the following caution:—"We run the risk while we dissolve one ingredient of precipitating another. . . . The nearest approach to a solvent possessing the properties" required "are those forms of the alkaline carbonates in which the carbonic acid is in great excess—in short, such compounds as exist in a great many natural mineral waters, and particularly in those of Vichy." The *modus operandi* of these and of certain artificial mineral waters, recommended by him, is explained in his work, and he expresses his belief that some, though not very much, impression may be made by them on the calculus.

He entirely disapproves of injections into the bladder with the object of dissolving the calculus, and says that the only condition to which they are adapted is a diseased state of the mucous membrane, accompanied by a tendency to the deposition of the phosphates.

Dr Beale has explained, as follows, his views of Dr Beale on diluents. the importance of diluents, and their mode of action:—"By causing much fluid to traverse the tissues of a living animal, comparatively insoluble substances may be washed out." It is his opinion that we can on this principle explain the benefit of the comparatively prolonged course to which patients are subjected in a German bath or hydropathic establishment, and he says—"It too often happens that, in endeavouring to perform quickly, by remedies, that which it is only possible to effect by giving large quantities of fluid during a considerable period of time, we disappoint ourselves and our patients. . . . In certain cases of gout, in chronic rheumatism, and in many cases where uric acid and urates are constantly deposited in the urine or in the tissues of the body, the most important of all things is to ensure the thorough washing out of the system" by means of exercise, hot baths, Turkish baths, &c., so that sweating and consequently thirst may be excited. "It is surprising how very little fluid some persons take habitually, and this fluid,

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small as it is, is often saturated with soluble substances. The fluid thus introduced is, in many persons who live well, barely sufficient to hold the various compounds in solution while undergoing chemical change."

Sir H. Thompson's
advice.

Sir H. Thompson's views, as expressed in his 'Clinical Lectures,' on the treatment best adapted for the prevention of calculous disease, appear so sound that I have made full quotations of them. It will be observed that he estimates Vichy water less highly as a remedial agent than Dr Prout does.

The pathological similarity of the following two substances, stated in the first chapter of this work, is thus referred to by Sir H. Thompson:—"The deposits of oxalate of lime and of uric acid so often replace each other that the consideration of the latter becomes practically generally sufficient for our purpose."

This author writes:—"What are we to do for those who habitually pass the Cayenne-pepper crystals of uric acid or small calculi? You will first seek the patient's antecedents, and learn all that he has to tell you of his habits, his diet, and his family history; and your mode of treatment will be determined accordingly." The administration of alkalies to the patient, he thinks, too often forms the main portion of the treatment:—"He has soda or potash largely administered, or

he will be told to drink so many glasses of Vichy water, which is mainly a strong solution of carbonate of soda, only it is a natural instead of an artificial one. Now, it is quite true that with alkalies, provided enough be taken, these deposits will disappear; the uric acid will no longer be deposited, the urine will become less irritating, the annoying symptoms will be diminished or got rid of . . . you have not checked the acid formation. The uric acid is there as much as ever, but the uric acid and the urates are soluble in alkali, and you have only made them invisible. . . . So far from sending them to Vichy or giving them alkalies, I believe they can be more effectually dealt with by a different mode of treatment. . . . Now, at the bottom of this tendency to uric-acid production there often lies what is thus understood as inactivity of the liver, and the true *rationale* of the unduly large formation of the urinary salts appears to be that, the liver or some allied organ not doing its duty as an excreting organ, the kidneys have more work thrown upon them. Thus, the solid matters of the urine, or rather some of its ordinary constituents, are augmented—not all of them, for urea is not necessarily increased, but uric acid is largely produced, and is eliminated, not only in solution, but in crystalline forms. . . . The treatment,

then, which I advise you to pursue is to employ such agents as will stimulate the excretory action by the primæ viæ without depressing vital power." Certain kinds of mineral waters he considers more harmless in promoting the function of the liver than mercury or other remedies. He says—"The mineral waters which I refer to belong to a group of springs all containing sulphate of soda, and some of them sulphate of magnesia, also, in solution." The two he especially recommends are the Friedrichshalle and the Carlsbad, taken alone or in combination every morning for a period of six to nine weeks. As these are out of the reach of patients in India, sulphate of soda as a substitute should be given in a dose sufficient to cause one movement of the bowels, and it is satisfactory to know the estimation in which this author holds it:—"Glauber's salt' is one of the most admirable medicines we possess, and deserves to be more popular than it is. I constantly order it, with or without a small addition of sulphate of magnesia, for the out-patients, as the best substitute within my reach for the mineral waters in question." On the subject of diet, he writes:—"There are three classes of aliments which must be permitted to the patient very sparingly, in order to attain the end in view—viz. alcohol, saccharine and fatty matters." Among these

the article the consumption of which will especially require to be limited in India is the second, saccharine matters being the only substance of the three commonly taken in excess by natives of that country. Another hygienic measure, which should be carefully attended to, is to see that the patient protects his skin with sufficient clothing.

Choice of operation

This subject would have found a place in the earlier part of the work, but, preferring as I do the common lateral operation (if lithotrity cannot be performed for the smaller-sized stones) for nearly every description of calculus except the largest, I did not think it required more prominent notice.

General maxims

The following general maxims for the performance of the lateral operation, laid down in Druitt's 'Vade Mecum,' cannot be improved upon:—

“1. To make a free incision, and to bring it low enough down, so that the urine may subsequently escape freely without infiltrating the cellular tissue. 2. Not to cut deeply too high up,

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nor to open the urethra too much in front, for fear of dividing too much of the urethra and wounding the artery of the bulb. 3. Not to wound the rectum or pudic artery by carrying the incision too low, or cutting too much inwards or outwards; the left forefinger should protect the rectum throughout. 4. Not to cut *through* the prostate. And 5. To extract the stone, when large, in the line of the axis of the inferior aperture of the pelvis.

Internal Incision

The manner in which the internal incision should be made deep enough for the extraction of a large calculus is perhaps the most difficult subject connected with the left lateral operation of lithotomy. As stated in Chapter VIII, I prefer to endeavour to obtain this object without allowing the blade of the scalpel to leave the staff at all, and I think that, with very few exceptions, it will be found possible to do so. At the same time, as a too exclusive adherence to my advice might not on all occasions be judicious, I will here quote Sir H. Thompson's views, as given in his clinical lectures, venturing, however, the preliminary remark that, while allowable for an experienced operator to make the rather free use of the knife mentioned below, it may be safer for a young one

to be more sparing with the scalpel:—"The depth of the incision will depend upon the angle which the knife makes with the staff; if you withdraw with the knife close to the staff, of course you will only make a wound the width of the knife, and if the edge is directed outwards and downwards against the soft parts with a light hand, as you come out, you will make a freer and cleaner opening. It is better to be rather free in cutting than otherwise (the presence of a large stone is assumed), but you must not make the incision too wide. There has been a great deal of good advice expended upon this subject—the depth of the incision, but it is manifestly impossible for one man to make another understand what he means or what he does by any amount of talk. My belief is, however, that the result of our anxious care about this matter is, practically, that we are apt to cut rather too niggardly than too freely, and that the neck of the bladder in consequence receives severer injury from the stone and forceps than it otherwise would receive from the knife."

Very small Calculi

Calculi below a certain size are so readily disposed of by the lithotrite that Sir H. Thompson informs me he looks upon the crushing of them as

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such minor operations, that he does not enter them in his list of lithotrity cases.

Treatment.

In the absence of a lithotrite, or before using it, other plans of treatment may be tried, and as far as medical means are concerned, no advice can be better than Dr Prout's, who, after remarking that as a general rule whatever passes down the ureter can pass through the urethra, says that it should be removed as quickly as possible by "attempting to allay, by antispasmodics, that irritable state of the sphincter of the bladder which often exists under these circumstances, and prevents the calculus from entering the urethra;" and "by the exhibition of simple diuretics, or diuretic purgatives, with the view of increasing the flow of urine," such as Rochelle salts, spt. æth. nitric., spt. junip. comp.; diluents, as barley water, linseed tea, soda or potash water.

The surgical treatment is very simple if a lithotrite is at hand, but, without that instrument, an endeavour may be made to extract the little stone from the bladder by forceps inserted through the urethra; or dilatation of the passage may be tried by inserting into the urethra and bladder bougies of gradually increasing sizes, on the plan recommended in the chapter on Urethral Calculus, and when full dilatation has been accomplished, "let the patient," Brett writes,

“drink freely of diluents, in order that the bladder may become distended, and when the patient is compelled to expel the urine, let him lean forward and suddenly withdraw the bougie. Stones which have for months lodged in the bladder may thus be extricated.”

By care, the nucleus of the stone may be got rid of before it has formed a calculus so large as to give trouble in its passage along the urethra, and with this object Mr Bryant's advice should be followed:—“Patients who are prone to the passage of renal calculi into the bladder, and to the formation of lithic-acid and other gravel, should be directed once a day, when the full bladder is about to discharge its contents, to arrest the flow of urine by holding the penis, and then suddenly to allow the stream to flow; in this way the water passing with a rush carries away any small stone or sand that may be resting in the bladder. . . . Old men should do this on their hands and knees.”

Relapse or Recurrent Calculus

From the tabular statement which appears in the article on incontinence of urine, it will be seen that, in 59 cases operated upon by me, relapse took place twice. Mr Coulson writing on

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this subject says :—"The most correct registers are probably those kept at the Norwich and Luneville Hospitals, and from them we learn that relapse occurred after lithotomy once in 58 cases at Norwich, and once in 116 cases at Luneville." This, therefore, gives an average of one case of relapse in 87 patients operated upon.

He writes :—"The return of the disease may take place under two circumstances, which it is highly necessary to distinguish. One or more fragments of the original calculus may have been left in the bladder, and become the nuclei of secondary formations ; or the bladder may have been completely freed, and the relapse depend on the same constitutional disposition which gave rise in the first instance to the deposit of calculous matter from the urine."

I agree with the opinion, expressed by Mr Spence below, that the ordinary lateral operation is as applicable to recurrent calculus as to ordinary cases, and that the performance of the operation is as easy in the former as in the latter, sometimes even easier.

There is one point, however, which requires extra caution—the coats of the rectum are often adherent to the old cicatrix, and may without care be wounded. Mr Spence's words are :—"It has been advised that the incision should be made on the right side of the perineum, and the right

lateral lobe of the prostate divided. The reason assigned for this recommendation is, that the textures formerly cut will be so condensed and resistant as to render their division and the extraction of the stone very difficult." In one case of this kind he operated upon, he says:—"I not only met with no difficulty, but feel satisfied that the textures were atrophied so as to render the perineum shallower, whilst the prostate, usually rigid in old men, offered no resistance, the incision yielding easily to the pressure of a finger. In a word, the operation was easier than usual in performance, and scarcely was a tablespoonful of blood lost."

Operation à deux temps

I am of opinion that much injury is the result of long and fruitless attempts to extract, and I have explained in previous chapters some circumstances in which I think the stone should be left in the bladder, and extraction completed à deux temps, a proceeding which is generally undertaken as soon as suppuration is fairly established, and the parts have become relaxed.

The management of these cases must be very carefully attended to until extraction is accomplished, for the calculus is liable to fall over the

neck of the bladder, preventing the escape of urine, a state which requires the occasional introduction of the finger for its relief.

†

Right Lateral Lithotomy

The necessity for operating on the right instead of the left side of the perineum must be very rare indeed.

Circumstances which have rendered it needful are thus stated by Dr Gross :—" Projection of the thigh, caused by ankylosis of the hip-joint, offered an effectual barrier to the left lateral section ; and in an instance recorded by Zeiss, a similar course of procedure was necessitated by the occupation of the left side of the perineum by a congenitally displaced testicle."

South, writing in Chelius' 'Surgery,' says, it may be required "if the rectum, instead of being directed behind the prostate, be on its left side."

Spontaneous Fracture of Calculus

Spontaneous fracture is known to have occurred on rare occasions. It is a condition of much danger, for the rough, sharp fragments of the stone will quickly cause inflammation of the mucous lining of the bladder, and death can then

only be averted by a speedy recourse to lithotomy.

Incontinence of Urine after Lithotomy

I give below a memo of mine, already published in the 'Indian Medical Gazette' for 1873, on the frequency of the recurrence of stone, and on the proportion of patients who suffer from incontinence of urine after the operation; but before considering the table, it will be useful to inquire into the opinion of authorities on this subject.

Poland says that temporary or permanent incontinence of urine may result, but is not very common; that it is mostly met with in children, and may be cured by attention to the general health and to the passing of the urine; and that as age advances, it will generally pass off. The cause of the affection in children was thought by Key to be, usually, that "the patient was allowed to leave his bed too soon after the operation, before the neck of the bladder is firmly healed, and the sphincter has recovered its tone."

Sir H. Thompson writes:—"Incontinence of urine occasionally follows the operation. It occurs more frequently in patients below the age of puberty than in adults. Apart from those rare instances of extremely large stone in which the neck of the bladder has been extensively

damaged, no very clear explanation of the cause can be afforded."

The treatment, he says, will not differ from that for ordinary incontinence, and he especially mentions one case in which perfect success followed the cauterizing of the neck of the bladder.

Gross recommends that gentle, but steady, pressure should be applied upon the perineum with the pad of a **T** truss, and in obstinate cases approves of cauterization of the commencement of the urethra.

Memo on recurrence of calculus and on incontinence of urine.

Total number of cases reinspected.	Number who have suffered from a recurrence of stone.	Number who suffer from so much incontinence of urine as to interfere with the duties of life.
59	2	Distressing incontinence ... 3
		Much inconvenience from incontinence 2
		Total..... 5

I operated upon the cases entered here between the years 1861 and 1865, in India; and they were visited by me at their villages during the cold season of 1864-5.

Sexual Impotence after Lithotomy

Both Sir H. Thompson and Mr Coulson speak of this affection as a very uncommon one.

The former authority doubts that it depends,

as sometimes stated, upon division of the seminal duct, but believes that "loss of virile power is generally due either to sloughing from violence, Cause. or to inflammatory action in and around the duct and vesiculæ seminales, destroying the function of these organs as conduits for spermatic fluid."

It is an irremediable affection.

Treatment.

Treatment of last stages of calculous affections unfit for operation

Dr Prout has dwelt upon this subject in his work. After remarking that the last stages of calculous affections are almost always accompanied by disease of the bladder, an alkaline condition of the urine, and by the deposition of phosphates; and after forbidding the exhibition of alkalies in such cases, he says:—"Thus the use of opiates (of which, perhaps, the muriate of morphia conjoined with hemlock or henbane is one of the most efficient) may be given with the decoction or infusion of *Lythrum*, *Pareira brava*, *diosma*, or *alchemilla*, all of which may be acidulated or not according to circumstances."

PART II—URETHRAL CALCULUS

CHAPTER XX

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Causes.

URETHRAL calculus is more commonly met with in children than in adults, and depends upon four causes.

The first, and much the most common, is the descent and arrest in the urethral canal of a calculus formed in the kidney. A second, and also a common cause, is the impaction of a fragment of a stone after the operation of lithotrity. Thirdly, it may, though very rarely, form primarily in the urethral canal. Fourthly, and also rarely, it forms on a foreign body introduced from without.

Character and form
of calculus with usual
site.

The first variety is generally composed of lithic acid or of oxalate of lime, and is of a round, elongated, or spindle shape: it is frequently found at the bulb or in the fossa navicularis.

The third variety is always phosphatic, and sometimes forms behind a stricture, or at other times originates externally to the urethral canal,

with which it often communicates by a small opening only. Chelius describes the mode of formation of these as, “such as have been deposited in the cellular tissue by the destruction of the walls of the *urethra*, and have grown by the continual deposition of the phosphates, or have been produced by the penetration of the urine into clefts of the *urethra*, into fistulas, wounds, and the like, into the cellular tissue itself.”

The first symptoms generally occur suddenly, Symptoms. owing to the escape of a calculus from the bladder into the urethra while the patient is in the act of micturition; the stream of urine becomes interrupted; straining with urgent desire to void urine comes on, as well as burning or tearing pain in the urethra at the site of the concretion. If the calculus escape, all these symptoms abruptly subside; but if not, they continue, and complete retention of urine may even take place.

Examination with the sound must always be Sounding. made, and, unless the calculus be pouched or fixed behind a stricture, will always be successful in eliciting the characteristic sound. A very necessary precaution while using the sound is to place one or two fingers on the vesical side of the stone, either from within the rectum or on the skin from the outside of the urethral canal, so as to prevent its being pushed back into the bladder.

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Difficulties in
sounding.

Mr Coulson, writing of impacted fragments after lithotrity, says that when the surgeon has failed to strike the fragment with a metallic sound, the symptoms continuing all the time, "a large-sized soft bougie is to be passed down the urethra, for it is possible that the fragment may be lodged in one of the lacunæ. If this be the case, the edge of the fragment, as M. Civiale observes, seldom fails to leave a mark on the bougie, whereas a metal sound might pass over it without any sensation being communicated."

Another obstacle to striking the calculus with the sound occurs when it is seated behind a stricture. In a case of this kind, which was not at first understood, Mr Teevan could elicit no sound until he moved the supposed stricture up and down on the staff, when a metallic click was heard; this case, along with the treatment adopted, is described further on. If this or other manœuvres fail in obtaining evidence of its presence, yet the real nature of the disease may be suspected if the patient has been in the habit of passing small calculi, or if he has recently suffered from symptoms of the descent of a calculus down one of the ureters into the bladder.

In the variety in which the calculus is lodged outside the urethral canal in a pouch or cyst, it will be impossible to strike it with the sound, even

when it is of considerable size, unless it partially project into the urethra; and to add to the obscurity of the case, the general symptoms may be very slight, there being little obstruction to the flow of the urine; it may, however, generally be diagnosed by the hard, nearly painless, frequently large swelling the concretion causes.

The simplest plan of treatment, sometimes Treatment. successful when the stone is situated towards the anterior part of the urethra, is to work it steadily forwards by means of the finger and thumb applied especially along the under surface of the urethra, the patient being under the influence of chloroform. Success will be rendered more Injection of oil. probable if oil has been previously injected into the urethral canal to dilate and lubricate it, and while this is being done, the precaution must not be omitted of making pressure behind the calculus to prevent its being driven back by the force of the injection.

An almost equally easy mode of treatment is Forcible expulsion of urine. for the patient to retain his urine in the bladder as long as he possibly can, either by his own efforts or by a large metal bougie tied into the urethra; while he partakes freely of diuretic drinks. The surgeon at the time of micturition (if no bougie was applied) compresses the urethra in front of the calculus, and directing the patient to make a powerful effort, suddenly withdraws

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Charles Bell's
directions.

the compression, when the calculus sometimes follows in the gush of urine which takes place.

Charles Bell's directions on this mode of treatment deserve notice; they were—to compress the urethra in front of, but not close to, the calculus; and his reason for this advice was that, on the patient making a powerful effort, the urethra in front as well as behind the stone is distended to its greatest degree, and thus a facility given for the progress of the stone forwards.

Dilatation with
bougies.

If these means should fail, the urethra must be dilated with bougies of gradually increasing sizes until one can be passed equal in diameter to the stone that is retained, and a warm bath should be given, when convenient; the calculus will then come away during micturition or may be removed with a forceps, the extraction being facilitated by drawing forwards the penis, and by grasping the urethra behind the calculus to steady it and prevent its displacement backwards.

Extraction with
forceps.

There is a great variety of forceps in use; those which are generally successful in ordinary cases are either the common long slender urethral forceps, or the polypus forceps of the dressing case. Other useful kinds are the urethral canula forceps of Weiss, both straight and curved, and the scoop with a tongue; the plates of the two latter here given, are copied from Druitt's 'Vade Mecum.'

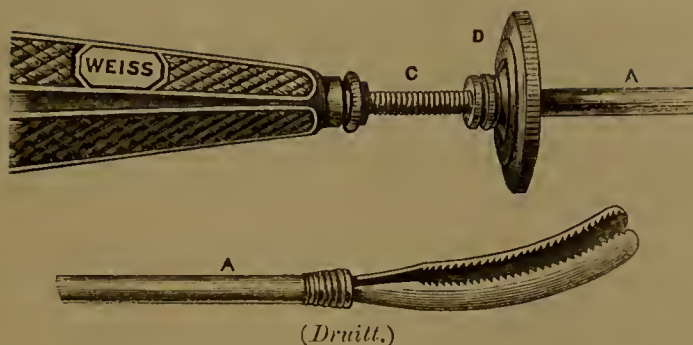


FIG. 9.—Curved urethral canula forceps of Weiss. These consist of two blades, capable of being expanded by being pushed through the canula, A, and of being closed if the canula is pushed forward over them; D, a screw, regulates the distance to which they can be expanded.



FIG. 10.—Scoop, with tongue.

The urethral forceps with double lever, the plates of which (see next page) are copied from Gouley's work on 'Diseases of the Urinary Organs,' appear serviceable, and are said to be sufficiently strong to crush soft stone or fragments.*

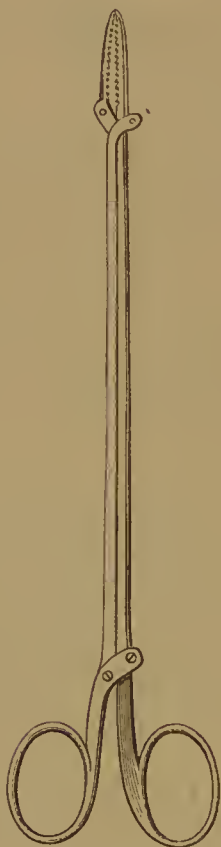
Hunter's urethral forceps are also thought highly of.

Instead of forceps, Mr Erichsen says a urethral scoop made by Coxeter on the model of Civiale's may be used (see fig. 202 in Erichsen's 'Surgery,' 6th edition), which being introduced

Extraction with scoop.

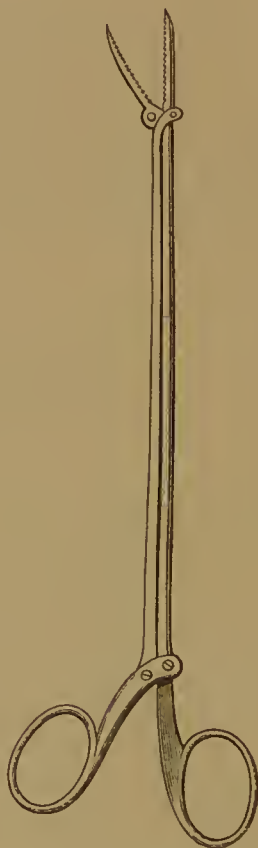
* The projection at the joint of these forceps, rendering them apparently liable to bruise the walls of the urethra, is a defect which it would be an advantage to remedy if it could be done without interfering with their peculiar action.

straight and passed beyond the stone, is curved forwards by means of a screw in the handle, and so enables extraction to be effected.



(Gouley.)

FIG. 11.—Urethral forceps, closed.



(Gouley.)

FIG. 12.—Urethral forceps, open.

A much simpler scoop than this has often been used successfully, the kind usually employed being either a slender one of the ordinary description set in a long narrow handle, or an eyed probe, with its eyed end bent so as to form a sort of scoop. An account of the best way of using the

latter is given in Chelius' 'Surgery':—"It is to be gently insinuated between the walls of the *urethra* and the stone, till its point has got completely behind the latter. Then pressing the stone forwards with the thumb and finger which grasp the *urethra*, the probe is gently and by little jerks to be drawn forwards, bringing with it the stone, which is to be closely followed with the thumb and finger of the other hand."

If on bringing forward the calculus, it be detained at the orifice of the *urethra*, or if it be originally impacted in the fossa navicularis, it will be necessary to dilate the meatus slightly by means of a probe-pointed bistoury, the incision being made by the side of the frænum.

Incision of urethral orifice.

No prolonged or rough attempts should be made to extract by means of the forceps lest the *urethra* be injured; but the calculus, if it refuse to advance to the orifice, should be pushed by means of manipulation and instruments back into the membranous portion of the *urethra*, where it must be cut out by the following means:—Insinuate, if possible, a small staff past the stone into the bladder, but if this cannot be done, introduce one down to the stone, and open the *urethra* upon the end of the staff and over the seat of the calculus by means of a sufficiently long incision in the centre of the raphé; when if it be thought

Incision of membranous portion of *urethra*.

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necessary to enlarge the wound, it is well, if possible, to pass a director into the urethra from the perineum by the side of the stone to guide the incisions : this being done, the calculus must be extracted, care being taken by planting the finger and thumb of the left hand firmly on the outside of the urethra behind the stone, or by a finger in the rectum if needful, that it does not slip back into the bladder.

After the operation, a catheter should be kept in the bladder for several days, if it can be borne.

Bladder to be examined after extraction of calculus.

As urethral calculus is not unfrequently met with in combination with vesical calculus, the surgeon should, after the extraction of the former, never omit to examine the bladder carefully to ascertain whether it contain a calculus, and if one be found, it should be at once extracted by the median operation of lithotomy.

No incisions to be made in the scrotal portion of urethra.

The incisions just described are the only one allowable in the urethral canal for the extraction of calculus, for if made anterior to the scrotum they would, on account of the thinness of the coverings of the penis, be difficult to heal and apt to degenerate into troublesome fistulæ, while, if made into the scrotal portion of the urethra, the consequences would be still more serious, for the tissues are so lax here that any incision is liable to be followed by abscess and urinal infiltration.

When urethral calculus has lodged for a long period in the canal, a serious evil has, Mr Erichsen says, occasionally been met with; "viz., the ulceration of the urethra by pressure of the stone, which escapes into the areolar tissue, the formation of urinary abscess in the perineum, followed, perhaps, by extravasation of urine into the scrotum, and its diffusion along the superficial fascia in the usual direction, with the ordinary disastrous results of inflammation and sloughing that accompany and follow such infiltration. In this condition, the child, after suffering from the ordinary symptoms of vesical calculus, will become affected by intense irritability of the bladder, the urine passing with much pain every few minutes; or incontinence even will set in. Some purulent discharge will be observed about the meatus, and there will be some ill-defined swelling in the perineum, with much tenderness in this region. On passing a sound, no stone probably will be found, as this has escaped from the urethra, and is lying in a pouch in some part of the perineum, and in the midst of broken-down areolar tissue and pus; into this cavity the sound will readily pass." This state, I believe, will always be accompanied by much constitutional disturbance with high irritative fever.

The treatment, the same author says, "consists Treatment. of introducing a grooved staff, placing the child

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in the lithotomy position, and then freely incising the mesial line of the perineum, so as to open up the urinary abscess; in this the stone may be found, or it may be so enveloped in the sloughy tissues as to escape detection; perhaps it will escape through the wound in a few days, and be found lying on the bed. Should there be much hæmorrhage, a petticoat lithotomy tube should be introduced. If extravasation of urine have occurred, free incisions must be made in the usual way, and the child be put on a series of stimulating diets.”

Impaction of calculus.

Serious and even fatal results may occur if the calculus become impacted, one of the most common and dangerous effects being extravasation of urine, well described by Mr Bryant in his ‘Surgery’ :—“ In adult life I have never seen extravasation occur as a result of impacted urethral calculus, although I have seen complete retention; but in infancy and childhood almost all the examples of extravasation of urine that have passed under my observation have been the product of such a cause. I have seen it in an infant of fourteen months old. . . . The cases come under the surgeon’s notice as cases of retention; and if there is no condition of the penis present, such as phymosis, paraphymosis, or adherent prepuce, by which this symptom may be produced, there is a strong probability that a

urethral calculus is the cause. . . . Extravasation of urine in childhood is almost invariably the result of an impacted calculus. The calculus is also usually arrested in the perineum. It rarely passes into the penis." As soon as impaction takes place, the first symptom usually observable is that the micturition becomes more difficult and painful with frequent and urgent desire to pass water; complete retention is apt to follow, and if not quickly relieved, rupture of the urethra with extravasation of urine will probably ensue. Sometimes suppression of urine with uræmia carries off the patient.

These cases of retention of urine admit of no delay in the application of the means of relief: if the calculus is seated in the neck of the bladder or in the prostatic portion of the urethra, it must be pushed back into the bladder, and crushed by a lithotrite or extracted thence by lithotomy. If situated in the perineum, it can easily be extracted by incision into that part; but if anteriorly between the glans and bulb, an endeavour should be made to extract it by the urethral orifice, or to push it back into the perineum, where it must be cut down upon. Large metallic bougies or catheters should be used for pushing the calculus back, and it will be found very useful to employ a catheter with an open end in which the stone may lie, and so be pushed on by it into the

Treatment of
impaction.

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bladder. Through such a catheter also a stream of water may be injected with some degree of force, and the calculus be thus driven back. In pushing with the catheter much caution must be used, otherwise the instrument may pass between the wall of the urethra and the stone, or may make a false passage.

Impacted and
immovable calculus.

When the calculus is so firmly impacted in the neck of the bladder and prostatic portion of the urethra that it cannot be pushed back into the bladder, fortunately a condition of rare occurrence, Mr Coulson says its extraction may be exceedingly difficult; but recommends the following as the best plan of treatment:—If a small grooved staff can be passed into the bladder, he says, “We proceed nearly in the same way as during the lateral operation. The external incisions are the same; the membranous portion of the urethra is next opened on the groove of the staff, close to the anterior prolongation of the calculus if it has extended so far; all this is easy enough; but now come the difficulties; the staff may have passed to the right side of the calculus or above it, &c., instead of the left side, and our guide is lost. Should this occur, the operator must withdraw the first staff and pass a small one through the posterior part of the internal incision into the bladder, between the left side of the calculus and the wall of the canal; this done, he

Operation when a
staff can be
introduced into the
bladder.

divides the prostate with the knife conducted along the staff until a sufficient opening is made. The anterior portion of the calculus is now seized with a small forceps and extracted. From its peculiar shape it is often difficult to obtain a firm grasp of it, and should any difficulty arise from this cause, an attempt may be made to pass a hooked instrument behind the posterior portion of the stone. This part of the operation may be facilitated by introducing the finger into the rectum, but if all our efforts fail to extract the foreign body, it must be pushed back into the bladder, and the operation terminated, as if it were the simple lateral one."

The operation becomes still more difficult and hazardous where no staff can be passed through the urethra into the bladder. The same author says:—"Many writers on lithotomy recommend the following method; a grooved staff to be introduced into the urethra as far as it will go, that is to say, as far as the calculus; an incision is next carried down on the extremity of the staff, and an attempt made to pass a conductor from the opening in the membranous part of the urethra into the bladder. Deschamps affirms that by using some force a curved director with a bulbous extremity can always be introduced. If this can be done, the prostate is divided on the director, and the operation terminated as before mentioned.

Operation when a staff cannot be introduced into the bladder.

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Should every attempt to pass a staff or director fail, we are told that nothing is left but to perform Celsus' operation." I cannot recommend this operation, and agree with Mr Coulson that the incisions into the prostate would be of a dangerous character, and that the recto-vesical would be a preferable operation in such cases to incision made through the perineum.

Recto-vesical
operation required
in a few cases.

Precautions
necessary.

Mr Miller brings to notice that considerable alterations may have taken place in the bladder in cases where a stone of some size has long been resident in the prostatic portion of the urethra; a fact which should lead to great caution in carrying out operative measures. He says:—"It may have contracted completely on the stone; the ends of the ureters abutting on this, and there being no cavity beyond, the urine coming away constantly by stillicidium."

Incision of the
spongy portion of the
urethra.

As already stated, it is very necessary to avoid incision through the spongy portion of the urethra; but as this cannot always be done, I think it well to put on record a most interesting and successful case described by Mr Teevan in the 'Lancet' of the 25th of August, 1874, in which he was obliged to perform this operation on account of the calculus being situated between two strictures half an inch in front of the scrotum. He writes:—"I slid the skin away from the raphé one inch to the right,

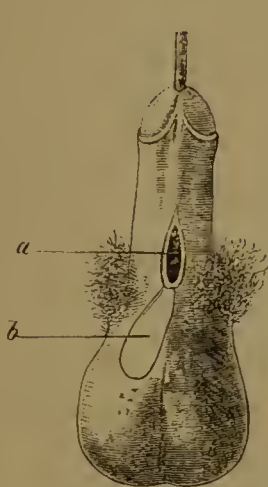
and removed the calculus through a small incision in the median line. The skin was now allowed to roll back to its normal position, so that the external incision appeared to be at the side of the penis, and not in the middle line where it had really been made. No instrument was left in the bladder, and no rigors followed." Mr Teevan then goes on to recommend, as quoted below, the valvular incision, as both an efficacious and a safe means of obviating fistula after external urethrotomy: considering, however, that it is the opinion of some authors that a *valvular* opening is liable to cause sloughing from diffusion of urine into the cellular tissue in its neighbourhood, I do not think this should be accepted as an established operation without further experience. Mr Teevan's words are:—"One of the objections to the performance of external urethrotomy in the penile urethra is the alleged probability of the formation of a fistula, but this may be obviated by adopting" the external valvular incision. "The skin of the penis is so loosely connected with the fibrous envelope of the organ that it can easily be shifted to a great extent in any direction. Thus it was that although the cicatrix is to be seen an inch to the left of the raphé, it was in reality made in the median line so far as all the tissues, save the skin, were concerned. The case also

demonstrates a surgical point, now generally accepted, to the effect that no instrument need be left in the urethra after internal or external incision, for neither rigors nor abscess occurred."

If an incision in the penile portion of the urethra should be made, either from such a cause as the above; from firm impaction of the calculus, or from a wish to preserve the meatus urinarius intact when a very large calculus is situated behind the glans, and should Mr Teevan's operation not be thought desirable, a urethro-plastic operation will afterwards become indispensable, which may be performed either by the Indian method (Fig. 13), or by lateral incisions (Fig. 14), as taken from Van Buren's 'Operative Surgery,' published in America.

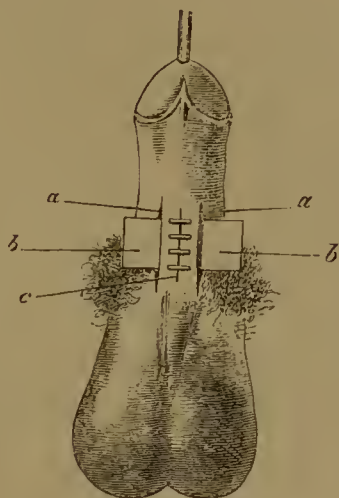
Mr Erichsen, writing on this subject, says:—"Operations of this kind require for their success very careful management and minute attention to detail; they very commonly fail in consequence of a small quantity of urine or of mucus escaping through the wound, and thus interfering with union of the lips. In order to prevent this accident, which is fatal to the success of the operation, the patient should be taught to pass a catheter, and thus to draw off his own urine after the operation as often as necessary; or an assistant must do this every third or fourth hour.

Should this, however, not be practicable, a full-sized gum catheter should be passed into the bladder and properly secured there. It should be left without a plug, so that no distension of the



(Van Buren.)

FIG. 13. — Urethroplasty by the Indian method. *a*. The outer line indicates the extent to which the skin must be pared away. *b*. The lateral autoplasmic flap cut from the integuments at the root of the penis. This flap should be a third larger than the wound it is intended to cover.



(Van Buren.)

FIG. 14. — Urethroplasty by lateral incisions. *a*. Lateral parallel incisions made a little longer than the fistula. *b*. A foreign body, such as a slip of india rubber or cardboard inserted under the fistula and through the incisions, to prevent the escape of urine through the fistula. *c*. The edges of the fistula having been pared, the skin, as far as the lateral incisions, is dissected up subcutaneously; points of suture are inserted three or four lines from each other, as shown above.

bladder and consequent likelihood of escape of urine between the urethra and the instrument may take place.”

He says that the surgeon has a choice of four operations (described at p. 746 of his ‘Surgery,’

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6th edit.), which he appears to think preferable to the Indian method, as I observe he does not refer to it. The last named, if it should be proved a satisfactory procedure, will always be limited in its applicability to cases, from being suitable for those only in which the fistula is close to the root of the penis.

Incision through
scrotal portion of
urethra.

Any incision through the scrotal portion of the urethra is, as above stated, attended with great danger, and therefore every means should be taken to avoid it; but if the stone should be impacted and immovable opposite the scrotum, the surgeon being unable to push it back into the membranous portion of the urethra or extract it by the forceps, it must then be cut out without delay. Lizars' directions are:—"Let the scrotum be pulled gently forwards towards the glans penis, and then let a free incision be made on the perineal aspect over the stone, through the skin and cellular tissue of the scrotum, until the operator feel the stone through the parietes of the urethra, which are lastly to be divided longitudinally. . . . The reason for the incisions of the scrotum being large is to prevent urinary infiltration and its consequences." When this incision is made, Mr Miller advises the surgeon "to cauterize the wound immediately with nitrate of silver to favour the deposit of lymph, and to abstain from micturition until the parts

are thoroughly consolidated. Or, instead of this, an incision might be made through the skin and cellular tissue over the tumour, and the wound stuffed with lint. The requisite amount of inflammation having been excited, the operation is completed by dividing the parietes of the urethra in the usual manner."

Urinary stones external to the urethral canal, Chelius writes, "may be removed by sufficiently cutting on the parts containing them, and if the stone be in the *perineum* and deeply lodged, attempts should be made from the *rectum* to press it through. If the cavity in which the stone lies be very large and hardened, it may be advisable to remove part of its walls. The after-treatment must be conducted according to the rules laid down for urinary fistula."

Operation for calculus external to the urinary passage.

Preputial calculus is well and concisely treated of by Mr Miller in his 'Surgery':—"When the prepuce is congenitally long and of tight orifice and the patient labours under calculous diathesis, a concretion may form exteriorly to the urethra within the cavity of the prepuce." The symptoms mentioned by him are:—"Painful and frequent micturition, congestion of the parts; the stone to be felt by manipulation, and also on the introduction of a probe through the narrow preputial orifice." The treatment recommended is as follows:—"By a curved bistoury the prepuce

Preputial calculus.

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is divided on its lower aspect; and by this simple incision two evils are at once remedied—the stone is dislodged, and the condition of phymosis is removed.”

Urethral stone complicated with stricture.

Besides employing means for removing a calculus when lying behind a stricture, it is very necessary to apply treatment for the obliteration of the stricture itself, otherwise a urinary fistula will probably be formed. Charles Bell recommended that in such a case of stricture a catheter should be kept in the bladder while the wound was healing; but if his suggestion be not followed, and a fistula should be the result, it will be necessary to thoroughly dilate the stricture.

PART III—CALCULUS IN THE PROSTATE GLAND

CHAPTER XXI

THE nucleus of the most common form of calculus in the prostate consists of inspissated secretion of the follicles of the gland. The inspissation results from vitiation and retention of the secretion. Hence these calculi are generally met with in old men, in whom the prostate gland is often in a state of subacute or chronic irritation causing disordered secretion; and are especially likely to occur if stricture of the posterior part of the urethra be also present, obstructing the exit of the secretion of the prostate. They also sometimes occur in young subjects. The nuclei are first seen as small red, yellow, or colourless masses of inspissated secretion scattered throughout the gland. They are composed entirely of organic matter, and produce no disorder until they increase in number and

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Cause.

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magnitude, when they create irritation of the secreting membrane of the prostatic follicles, resulting in the precipitation of earthy salts. This explains the deposition of the phosphate of lime on the organic nucleus, and the consequent formation of the calculus.

Dr Wollaston gives the chemical composition as follows :

Phosphate of lime	.	.	84·5
Carbonate of lime	.	.	·5
Animal matter	.	.	15·0

They are most frequently met with of a rounded or ovoid form, and not exceeding a plumstone in size. When larger, they become irregular in shape, often elongated, sometimes branched. They are white or pale brown in colour, and are hard in consistence, having some resemblance to porcelain. They vary in number from one or two, which is the most common, to 100 or more; in the latter case they will usually have facets from attrition with each other.

When the calculus is single and moderate in size, it lies in a duct, where it forms for itself a kind of cyst in the organ; but when of large size and branched, it distends the prostatic ducts, converting them into pouches, and projects into the urethra: this urethral portion may enlarge to such an extent as to reach backwards into the bladder, forming a prostatico-vesical calculus.

The calculi may become embedded in the prostate, and, as they increase in number and size, may cause absorption of the gland until the whole or a part of one of the lateral lobes is converted into a sacculus.

There are two kinds of prostatic calculi; the one above described, and the other resulting from a vesical calculus which has passed out of the bladder and become arrested in the prostatic portion of the urethra, where it has formed for itself a bed in the prostate.

The small masses of inspissated secretion which Symptoms. form the nucleus of these calculi produce no bad effects until they increase in size, when symptoms of enlarged and irritated prostate may follow, such as, uneasiness at the neck of the bladder, weight and pain in the perineum, much discharge of mucus, and frequent micturition, while, if they project into the urethral canal, obstruction to the flow of the urine may be occasioned. Inflammation of the prostate may also be set up, and result in abscess.

On sounding the patient, the sound will be felt to strike, or rather rub against, one or more calculi just before its beak enters the bladder: this sensation can seldom be felt whilst the sound is in the cavity of the bladder, but must be looked for just before its point enters or after it leaves the neck of the organ, and, unlike the impression of

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movableness conveyed by a calculus in the bladder, the concretion or concretions are always felt to be immovably fixed in one particular spot, except in the uncommon case of the instrument passing into a sacculus containing calculi and communicating with the prostatic portion of the urethra, as described below. The examination may be aided by the introduction of the finger into the rectum, by which the prostate can be pushed up and the calculus brought into more immediate contact with the sound: by this means also, in cases in which the calculus does not project into the urethra, the finger will usually feel it through the coats of the rectum: while if there should be many small calculi in a sacculus in the prostate, they will give a rattling sensation to the finger, like a bag of marbles when shaken. This sacculus sometimes communicates by a large orifice with the urethra, and then the sound, while passing along the prostatic portion of the urethra, will often enter it and detect the presence of the calculi.

Charles Bell mentions that sometimes the small calculi in the prostate gland may be felt on first sounding, but may not be detected on the next occasion. His explanation of this occurrence I have quoted in the chapter on Sounding.

If the calculi are small, it is sometimes possible to remove them through the urethra without an

external incision, by means of Weiss's long urethral forceps, his canula forceps, or the long cuvette. If a small vesical calculus or a fragment of one has recently lodged in the prostate, and it be found impossible to extract it with the urethral forceps, it should be pushed back into the bladder, and subjected to lithotrity.

When larger, if the calculus is situated on the urethral surface of the prostate, and so readily struck with the sound as to indicate that a considerable portion of it lies free in the urethra, a staff having been inserted into the bladder, the ordinary median operation may be employed, and the calculus extracted with the forceps or scoop. I myself have always practised, with facility and success, the left lateral operation for the extraction of these calculi, preferring it to the median operation, as affording more space for the use of the knife, and being more quickly performed and with less shock to the patient: when the calculus is large, especially if of the kind described above as prostatico-vesical, or when conjoined with vesical calculus, it certainly should be adopted in preference to the median operation. The latter is thought by Erichsen to be the best "in cases in which the patient is so anæmic that the loss of an additional ounce or two of blood might turn the scale against him."

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The presence of stone in the prostate dilates it to such an extent as often to afford room for the extraction of the calculus without the incision of any part of the gland.

If the calculi be small and numerous and contained in a sacculus in the prostate, not to be felt with the sound, but only by the finger in the rectum, Erichsen advises that no operation should be performed, inasmuch as the whole of the concretions could not be removed. In this condition, however, if the symptoms are so urgent that an operation is decided on, the gut being dilated by the speculum ani, the sacculus should be cut into, and the calculi extracted through the rectum.

When, in such a case, the calculi can be felt by the sound through the urethra, the lateral is probably a better operation than the one just described.

When there is no urgent suffering, it is the practice with some surgeons not to operate, as it is said that calculi in the prostate are most generally multiple, occurring in both lobes of the gland at the same time; and this, no doubt, is the most advisable course to adopt if there be any doubt as to their situation being favorable for complete extraction.

When marked symptoms of distress are present, and the foreign body or bodies can be plainly felt by the sound to project into the urethra anterior

to the neck of the bladder, and to be single or not more than two or three in number, they should be extracted lest, by remaining in the substance of the gland, they lead to abscess and disorganisation ; but if the calculus be so embedded in the prostate as to give no distinct metallic ring from contact with the sound, it is considered the wisest plan not to interfere with the case by operative measures, but to use a palliative treatment only, adapted to the relief of irritation of the prostate ; and at the same time to improve the general health, preventing phosphatic deposit by the use of nitric acid.

It is satisfactory to know that in these circumstances a natural cure may possibly take place by the advance of the calculus into the urethra, and its subsequent discharge ; or by its exciting ulceration towards the rectum, and passing by stool.

Brodie mentions that where there are a number of small calculi in different parts of the prostate, palliative treatment should be preferred ; he says : —“ There seems to be nothing for us to do beyond the occasional introduction of a full-sized bougie, to keep the urethra dilated, and thus favour the escape of the calculi as fast as they become disentangled from the ducts of the prostate in which they have been generated.”

PART IV—STONE IN FEMALES

CHAPTER XXII

CHAP. XXII.

Relative frequency.

CALCULOUS depositions are not so unfrequent in females compared with males as is generally supposed, though the retention of a calculus in the bladder, with the consequent necessity for operative relief, is certainly not nearly so common in the former; in whom, the urethra being short and dilatable, the calculous matter usually escapes as quickly as it is formed.

The proportion of women operated upon is one to about twenty men.

Prognosis.

A calculus in the bladder of a female is not thought to give rise to serious disease of the organ so quickly as it does in the male; though, if not removed, it would eventually produce the same distressing and finally fatal consequences. This result has, in very rare instances, been averted by the stone ulcerating its way through

the walls of the bladder into the vagina, leaving, of course, a vesico-vaginal fistula.

The causes are the same as those in the male, Causes. but there is one special cause in the female which is much commoner than it is in the other sex—this is, that the nucleus is sometimes found to be composed of some foreign body, such as a piece of pencil, a hairpin, &c., which, with the object of relieving irritation or from other motive, having been inserted into the orifice of the urethra, has accidentally slipped into the bladder, and has there given rise to a deposition of phosphatic calculous matter around it.

The symptoms are much like those met with in Symptoms. the male, but in the female there are two peculiar to the sex, consisting in bearing-down pains and incontinence of urine, the former of which after micturition gives an agonising sensation of the bladder, rectum and uterus being forced through the lower opening of the pelvis, while the latter leads to the patient being always wet, with an offensive urinous smell.

A vascular urethral tumour and an irritable bladder in a female produce symptoms resembling those of calculus vesicæ, and, on account of their more common occurrence, may lead to the presence of calculous disease being overlooked. A more frequent mistake has been to take the symptoms of stone for those of uterine mischief ;

Similarity of symptoms with those of other diseases.

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but this would be avoided if in doubtful cases the state of the female bladder were always examined with a sound.

Sounding.

Examination of the interior of the female bladder should be made with a short and nearly straight sound, aided by one or two fingers in the vagina of a woman or in the rectum of a child, to tilt the calculus up towards the point of the instrument. Mr Miller mentions one source of occasional obscurity in sounding. He says that sabulous matter sometimes collects just within the lower part of the orifice of the female urethra, and may be overlooked by the sound, unless attention is specially directed to that part.

Anatomy.

Before inquiring into the subject of the best operative procedures, it will be advisable to consider the anatomy of the female perineum and urethra, as this varies so much from that of the corresponding parts in the male as to render an entirely different mode of extracting the calculus necessary. The position of the neck of the bladder and of the urethra with the length of the latter is thus described by Mr Coulson:—"The neck of the bladder lies between the vagina and symphysis pubis, about an inch below the angle of junction of the bones, and from this point the urethra runs forward in nearly a straight line for about an inch and a half, to terminate in its external orifice, just below the clitoris."

The subject of the anatomy of the arteries of the female is not of great importance in reference to the operations about to be considered, as hæmorrhage is a rare result, and is only at all likely to be met with after upward and outward incisions. The branches which may then be wounded are the two terminal ones of the internal pudic artery which supply the clitoris.

The operation most suitable in the female for Operations. the extraction of small calculi is dilatation alone. For larger ones, dilatation of the urethra with or without incisions should be combined with crushing of the stone with a lithotrite or a strong forceps; except under the special circumstances described below, when for adult women the vaginal method will be the best. This operation is not applicable to children and young unmarried females; and in them, if the calculus cannot be crushed, the only operation which remains will be that of urethral lithotomy.

Dilatation of the urethra without incision, as the Simple dilatation. most simple operation, will be described first. It is applicable to the removal of small-sized stones only. Dilatation may be performed either by the slow or the rapid process. It was formerly supposed that the slow method was the least likely to injure permanently the neck of the bladder, and so lead to incontinence of urine; but opposite opinions have been expressed by Mr Bryant, of

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Guy's Hospital, who advocates rapid dilatation on the principle that the elastic tissue of the neck of the bladder is more likely to recover its tone when rapidly stretched than when extended in a slow and tedious manner. On the other hand, Dr Humphry, of Cambridge, an equally high authority, strongly advocates slow dilatation. Quite recently Dr Greenhalgh, of St Bartholomew's Hospital, has informed me that he is fully of opinion that rapid dilatation is the least likely to cause permanent injury.

Slow dilatation is made by Weiss' dilator introduced, and very gradually increased in size daily. It may likewise be accomplished by making dilatation daily by bougies of gradually increasing sizes, Dr Humphry preferring catgut ones and taking twenty-four or forty-eight hours to complete the process, which is described in 'Cooper's Dictionary,' as follows:—"The catgut bougies, swelling with the moisture, dilate the passage in the most gentle and gradual manner. After three or four hours two or three more bougies are to be inserted, and additional ones in such numbers and at such intervals as may be found to be desirable, until the requisite dilatation is affected." Also sponge tents or gentian root may be used for this purpose. This dilatation is continued until a sufficient amount has been obtained to allow of the calculus being removed with the forceps, the

surgeon remembering that the dilatability of the urethra diminishes with the advance of age, and carefully avoiding dilatation to such an extent as to risk contusion or laceration of the neck of the bladder. As a guide to what this may be Mr Lane says :—"We are disposed to fix as a maximum for this operation a measurement of about three quarters of an inch in the short diameter of the stone for an adult, and half an inch in children." Gross is of opinion that it should be sufficient to admit the index finger, so that the dimensions of the stone can be ascertained, and a decision arrived at as to the necessity or not of incisions being made. This of course can only be accomplished in adult women, and in them no forcible endeavour should be made to do so ; but if the index finger cannot readily be introduced, it will be better to pass the little finger, or relinquish the attempt altogether to insert a finger until incision or other suitable treatment has been employed.

Rapid dilatation is most conveniently practised by means of Weiss' dilator introduced into the urethra and quickly screwed up. In the absence of that instrument, it can be accomplished by means of bougies of gradually increasing sizes inserted quickly in succession, the process to be completed with the finger or a polypus forceps.

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Dilatation with
incision.

Incision becomes necessary when, dilatation having been carried to its full extent, the calculus cannot be extracted (even with the help of lithotrity), as laceration of the mucous membrane of the urethra with injury to the neck of the bladder, and consequent incontinence of urine, is thus rendered less likely.

Mr Erichsen gives his opinion as to the best form of incision to make, as follows:—“The incision should be made after the urethra has been dilated to some extent, a probe-pointed bistoury being introduced by the side of the canal, and the mucous membrane divided. Brodie made an incision directly upwards; Liston downwards and outwards on each side—on the whole, I think the best direction for the incision, as more space may thus be obtained.” If this lateral incision is preferred, a straight staff ought, I think, to be passed into the urethra, to guide the bistoury, with the groove directed towards the left ischium; but if a double incision be called for, then the staff should be turned to the right ischium also, when making the incision on this side.

As to the extent of the urethra to be divided, no certain rule can be laid down. The mucous membrane of the tube may either be divided in its anterior half, or the incision may be confined to the neck of the bladder; in the former case the operation of Sir Wm. Fergusson may be practised,

and in the latter that of Mr Liston or Sir B. Brodie. I should feel disposed to choose Fergusson's operation, as described below, in preference to the others, with the object of avoiding an incision into the neck of the bladder, and would practise it either with an upward incision or with lateral incisions ; endeavouring in the latter case to avoid laying the urethral and vaginal canals into one, by confining my incision to one side of the urethral canal and incising the mucous membrane only, if I could by these means obtain sufficient space. Mr Druitt describes Fergusson's operation as follows :—"The anterior half, not its whole length into the bladder, should be divided to the extent of half an inch with a probe-pointed bistoury, after which sufficient dilatation may be effected with the forefinger. The outer part of the urethra, the most undilatable part, would be alone divided by this operation, and the neck of the bladder, unless very roughly used, would speedily acquire its tone and use. In this way this eminent surgeon has extracted a stone three inches in circumference, and the patient had the power of retaining her urine immediately afterwards."

If the incisions are confined to the neck of the bladder, the operator may choose either the late Mr Liston's or the late Sir B. Brodie's operation, according to his judgment. Mr Liston's plan

was to gradually widen the urethra by means of a dilator, and "then," he says, "by the introduction of a straight blunt-pointed knife notch the neck of the bladder slightly towards each ramus of the pubes, so as to divide the dense fibrous band encircling it; the dilatation is continued, and in a few minutes the finger can be admitted. Incontinence of urine may follow the operation from the distension of the sphincter of the bladder, but in a few weeks this will generally cease."

Sir B. Brodie's plan was to introduce a bistouri caché into the urethra, having first arranged it to cut one sixth of an inch only, and "then," he says, "drawing out the bistouri, with the cutting edge turned directly upwards, I endeavoured to divide the membrane of the urethra immediately below the pubes, without allowing the incision to extend into the contiguous cellular structure. The next step of the operation was to introduce Weiss' dilator, and dilate the urethra so as to allow of the introduction of the finger, and afterwards of the forceps, into the bladder."

Though venturing to make some slight suggestions as to the incisions I should myself prefer to adopt, I have not, however, as yet formed conclusive opinions on the subject, having been called upon to operate in twelve cases only of stone in females, and I feel that this experience is too

limited a one upon which to establish a decided line of practice.

Dilatation, with one of these incisions, will generally enable the operator to remove phosphatic calculi which have formed on foreign bodies introduced from without.

Without the crushing of the calculus, dilatation Lithotrity. even with the aid of incision will not allow of the extraction of any except very moderate sized stones, unless such undue stretching of the parts be made as will leave a permanently weakened state of the sphincter of the bladder. In the great majority of cases, therefore, crushing, either with a strong and conveniently shaped forceps or with a lithotrite, will have to be performed.

Before deciding upon the performance of lithotrity, the state of the urinary organs should be inquired into, as organic disease would exert an unfavorable effect; though, on account of the rapidity with which the operation can be terminated in the female, it would not do so to the same extent as in the male; at the same time, if the bladder were contracted, inflamed, or ulcerated, lithotrity ought not to be practised.

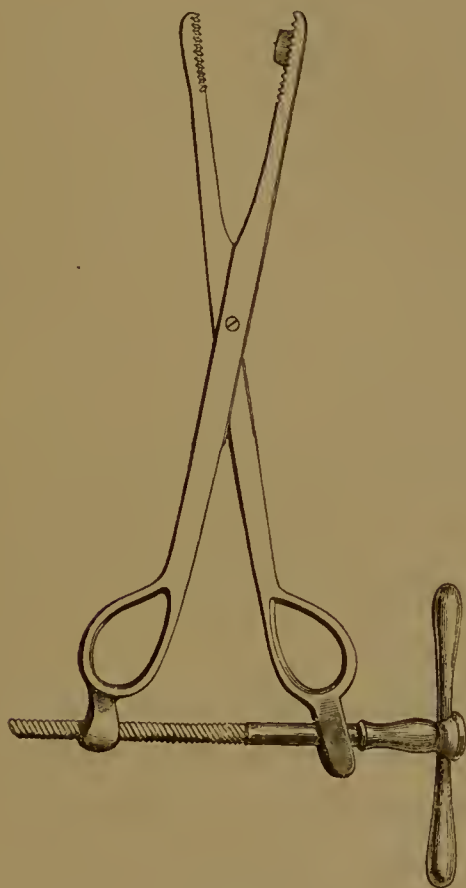
Lithotrity is applicable to females of all ages from $3\frac{1}{2}$ years upwards; and with reference to a child of this age, Mr Erichsen writes:—
“Although the urethra of so young a female child cannot without danger of incontinence be dilated

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to too great an extent, yet it may safely and easily be enlarged sufficiently to admit of an 11 or 12 lithotrite."

This author makes the following remarks on the present subject:—"Lithotrity in the female requires to be practised on the same principles as in the male. . . . The chief obstacle in the performance of the operation in the female consists in the difficulty with which the bladder retains urine or water that is injected into it. In consequence of this there is not only great difficulty in seizing the stone, the bladder collapsing and falling into folds around it, but also danger of injuring the mucous membrane with the lithotrite. In order to cause the bladder to retain the necessary quantity of urine, the pelvis must be well tilted up, and the urethra compressed against the lithotrite." He recommends a shorter instrument in the handle than that used for males, and to this I would add that it should be adapted in size to the age of the patient. "If urine or water cannot be retained in the bladder," he thinks, "the calculus may more readily be seized and crushed by means of a small and strong-bladed pair of lithotomy forceps; or, if the stone be larger, by a crushing instrument" (Fig. 15). It is necessary merely to break the calculus up, he says, "into fragments of such a size as to admit of easy extraction through the urethra. . . .

After the stone has been broken up, the urethra (unless this have previously been done) may be dilated by means of the two-bladed instrument to



(*Erichsen.*)

FIG. 15.—Crusher for large calculus in female bladder.*

a moderate degree, the larger fragments removed by means of a pair of slender forceps, and the detritus and smaller fragments cleared out of the bladder by repeated injections of tepid water," the whole being removed at one sitting.

* The projection seen on one of the blades of these forceps is too great, and would, I think, prevent a firm hold of the calculus.

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Mr Coulson has made some useful suggestions about certain points connected with this operation. He says that if difficulty should be found in inserting the lithotrite into the orifice of the urethra, this part should be dilated by means of bougies, or, if judged necessary, it may be nicked with a bistoury, and that if the urethra should be very sensitive and irritable, (a state much less common than in the male) this condition should be combated by appropriate means before the instrument is used.

The obstacles likely to be met with after the introduction of the lithotrite has been accomplished are not thought by Mr Coulson to be usually of a serious character, though one circumstance (less commonly met with than in the male) which should prevent the performance of lithotrity, is the bladder being so small and irritable as to be incapable of retaining the injection. This difficulty is not according to his experience of frequent occurrence; he says:—"Under ordinary circumstances the female bladder will retain the injection well enough, and if the bladder show any disposition to reject it, this can be overcome by elevating the pelvis a little more than usual, and by confining the quantity thrown in to four or five ounces. The rapidity with which the operation may be completed in the female renders it much less necessary to have the

bladder distended with fluid." It is well to be aware, as this authority has pointed out, that some delay and difficulty may arise from the lateral walls of the female bladder, which are naturally depressed, becoming so much so in the aged patient as to form a kind of sac at the floor of the bladder in which the fragments of the calculus may lodge; or the pieces of stone may become engaged in pouches formed by the pressure of the uterus against the posterior and inferior walls of the organ.

When the calculus is too large to be removed by dilatation with incision, and the bladder is too diseased to admit of lithotrity, the stone in an adult female should be extracted by vaginal lithotomy. Vaginal lithotomy.

Mr Coulson's rules for the performance of this operation are:—"The patient is placed in the usual position; a straight staff is passed into the bladder, the groove is directed downwards, and the end of the staff made to press against the vagina; the index finger of the left hand and a wooden gorget are also passed into the vagina, and the end of the staff is made to rest fairly in the concavity of the gorget. Both instruments are now firmly held together by an assistant, and the operator directs along his left forefinger the point of a straight bistoury until he arrives at the groove of the staff behind the neck of the

bladder, when he carries his incision forward to the extent judged proper. The very great probability that vagino-vesical fistula will result is the main objection to this operation ; but in cases of large calculi it has the immense advantage of not endangering life."

Mr Lane is a strong advocate for this operation in preference to urethral lithotomy, because the thin edges of the urethra are much more difficult to close by a plastic operation than are the thicker edges of the incision into the base of the bladder ; but to obtain a successful result in the latter, he says that the surgeon must make a sufficiently free incision into the bladder to allow of the extraction of the calculus without bruising the edges of the incision, and must be careful not to wound the urethra. In this, unlike the recto-vesical operation in the male, there is no fear of wounding the peritoneum, for it is reflected from the uterus to the bladder nearly an inch above the attachment of the vagina to the neck of the uterus.

The extent of the incision in the inferior fundus of the bladder should be one inch or one inch and a half, according to the size of the calculus ; and after extraction, the wound may be sometimes successfully closed by metallic sutures as for vesico-vaginal fistula.

Mr Lane writes in high praise of the effect of

the application of sutures :—"The experience of the last ten years has abundantly shown that almost every case of vesico-vaginal fistula, even when attended with great loss of substance, may be firmly and permanently closed by the improved plastic procedure now in use." The most conclusive article written in favour of the plastic treatment of vesico-vaginal fistula is one in Holmes' 'Surgery,' by Mr Hutchinson, in which the principles for its successful performance are so clearly laid down that I would strongly advise my readers to refer to it. In it the operation is spoken of as "a finished achievement." Mr Hutchinson mentions, in the same article, a reason why the plastic procedure after this operation is more successful than when applied after urethral lithotomy :—"The nearer the fistula is to the urethra, the more easy is the operation in performance, but the greater is the chance that it may fail. The difficulty in closing urethral fistula arises from the fact that the catheter presses on the line of union."

As an adjunct to this in cases of partial failure in the attempt to close the fistula, it may be useful to try Mr Lizars' treatment with the actual cautery at a black heat applied once every three months, with which he writes that vesico-vaginal fistula is easily curable.

Urethral lithotomy may be a necessary operation

in children, and young unmarried women in whom vaginal lithotomy is not applicable. Although Erichsen appears to prefer it to the vaginal operation for married adult females also, and says that if a want of union of the incised edges of the urethra should happen, it can easily be remedied by a plastic procedure at a subsequent period ; yet the arguments, put forward by Lane and Hutchinson, in favour of vaginal lithotomy are so strong and convincing that I think it must be considered the better operation of the two. Mr Bryant, in his recent work on ' Surgery,' has also condemned urethral lithotomy.

Mr Erichsen says urethral lithotomy " consists in placing the patient in the lithotomy position and tying her up. A grooved staff is then introduced into the bladder, and a sharp-pointed bistoury guided by it, is pushed through the floor of the urethra, about an inch and a half from the meatus, the canal being divided directly downwards." After the calculus has been extracted, " a full-sized catheter should be introduced and left in the bladder, and the cut edges of the urethra brought together over it by two or three points of silver suture."

Mr Lane, as already stated, opposes this method. He mentions the case of a child, aged $3\frac{1}{2}$ years, operated upon by Mr Paget, of Leicester, by urethral lithotomy, in whom it was impossible

to bring the edges of the urethra into apposition, incontinence of urine being the result.

Instead of the operation as described by Mr Erichsen, it might sometimes be sufficient to incise the orifice of the urethra alone, as in the operation quoted below, when permanent incontinence of urine would be much less likely to follow. Sir B. Brodie says that the woman was able to retain her urine for one or two hours only, but even this amount of incontinence would, I think, in these days, have been remedied by a plastic operation. Brodie's words are:—"I was led to believe that the whole of the female urethra could be dilated easily and to a great extent with the exception of the external orifice. . . . I made a small incision extending through the peculiar structure which surrounds the orifice of the canal but no farther. The wound did not extend more than one third of an inch, and was in the line of the urethra."

Mr Lane strongly opposes the supra-pubic High operation. operation. He thinks that "the high operation is the most dangerous of all the various methods which have been proposed, and that almost the only conceivable case in which it would now be justifiable would be one in which, with a deformed pelvis and a very large stone, extraction per vaginam was impracticable."

Foreign bodies introduced into the female

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Foreign bodies.

bladder from without are best removed by rapid dilatation with Weiss' dilator or with bougies, the finger, &c., and then extraction with a pair of delicate lithotomy or polypus forceps. This will often be much aided by the introduction of a finger into the vagina or rectum in order to manipulate and place the substance in a good position for removal, so that the surgeon may be enabled to seize it by one end. "For the removal of such a thing as a hairpin," Bryant thinks "a blunt hook may possibly be of use." When the substance is sharp and pointed, great caution should be employed, as well explained by Gross:—"When the ends are very sharp, or fixed in the walls of the bladder, the procedure must be conducted with unusual care, otherwise the organ may be seriously lacerated. Under such circumstances it is sometimes best to combine dilatation with incision."

After-treatment.

Dr Gross gives the following sound advice about the best after-treatment in the female:—"No matter how simple the operation may be, the strictest recumbency should be observed, not only until the parts are partially healed, but until they have in great degree fully regained their natural tone. When this point is properly attended to there is little danger of incontinence of urine."

Ratio of death.

Mr Coulson says that statistics founded on a number of cases, the majority of which were

operated upon by dilatation, show that 5 per cent. of females, if not more, die of the operation for extraction of calculus.

Mr Erichsen writes on the relative amount of Relative success. danger from the operation for extraction of calculus in the female, as follows:—"Lithotomy is not so dangerous an operation in the female as in the male; yet death occasionally occurs, especially in feeble children, from cystitis and peritonitis, more particularly if the extraction of the stone have been tedious and deficient, the bladder being much manipulated."

Calculus in the bladder has occasionally been Calculus in the bladder obstructing labour. met with obstructing labour. One unfortunate case is related by Mr Poland in which its existence was not known until after death—an oversight which could not have occurred if a catheter had been passed to ascertain the state of the bladder. This should always be done in cases of obstructed labour from apparent tumour, for without examination of the interior of the bladder, it is very possible to misunderstand the state of things, from the fact that although the calculus when associated with labour is usually movable in the absence of pain, yet it may sometimes be so firmly impacted between the head of the child and the arch of the pubes as to simulate a tumour.

If discovered during pregnancy, Mr Poland

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Treatment.

says it is both a safe and proper plan to remove it before labour commences. If not detected until the woman is in labour, and if placed below the head of the child, it may sometimes be possible to push it back above the head; but when this is not practicable, it must be extracted by some method. Mr Erichsen mentions a case in which he removed by the vaginal operation a stone measuring eight inches by six in circumference, which was obstructing labour.

APPENDIX

TABLE

Of weight, diameter, and circumference of fourteen calculi extracted by lithotomy

APPENDIX.

Weight.	First diameter.	Second diameter.	Third diameter.	Long circumference.	Short circumference.	Mean of the two circumferences.	Remarks.
3ij	In. 2	In. $1\frac{4}{8}$	In. $1\frac{3}{8}$	In. $5\frac{3}{8}$	In. $4\frac{5}{8}$	In. 5	These calculi were weighed by apothecaries' weight.
3ii 3iss	2	$1\frac{5}{8}$	1	$5\frac{1}{8}$	$4\frac{4}{8}$	$4\frac{1\frac{3}{6}}{1\frac{6}{6}}$	
3ij 3ij	$2\frac{2}{8}$	$1\frac{5}{8}$	$1\frac{1}{8}$	$5\frac{4}{8}$	$4\frac{6}{8}$	$5\frac{1}{8}$	
3ij 3iiij	$1\frac{7}{8}$	$1\frac{6}{8}$	$1\frac{4}{8}$	$5\frac{2}{8}$	5	$5\frac{1}{8}$	
3ij 3iiij	$2\frac{5}{8}$	2	$1\frac{4}{8}$	$5\frac{6}{8}$	$4\frac{4}{8}$	$5\frac{1}{8}$	
3ij 3vj	2	$1\frac{6}{8}$	$1\frac{2}{8}$	$5\frac{4}{8}$	5	$5\frac{2}{8}$	
3ij 3viss	$1\frac{7}{8}$	$1\frac{6}{8}$	$1\frac{5}{8}$	$5\frac{5}{8}$	$5\frac{3}{8}$	$5\frac{4}{8}$	
3ij 3vij	$2\frac{5}{8}$	2	$1\frac{4}{8}$	$6\frac{4}{8}$	$4\frac{7}{8}$	$5\frac{1\frac{1}{6}}{1\frac{6}{6}}$	
3ij 3vij	$2\frac{3}{8}$	$1\frac{5}{8}$	$1\frac{3}{8}$	$6\frac{1}{8}$	$4\frac{6}{8}$	$5\frac{7}{1\frac{6}{6}}$	
3iiij	$1\frac{6}{8}$	$1\frac{5}{8}$	$1\frac{3}{8}$	7	$4\frac{6}{8}$	$5\frac{7}{8}$	
3iiij 3j	$2\frac{2}{8}$	$1\frac{6}{8}$	$1\frac{5}{8}$	6	5	$5\frac{4}{8}$	<div> Successfully extracted by the left lateral incision alone; the prostate and neck of the bladder were in an unusually relaxed condition, otherwise bisection of the prostate would probably have been necessary. </div>
3iiij 3v	$2\frac{4}{8}$	$1\frac{5}{8}$	$1\frac{4}{8}$	$6\frac{6}{8}$	$5\frac{2}{8}$	6	
3iiij 3v	$2\frac{2}{8}$	$1\frac{4}{8}$	$1\frac{2}{8}$	6	$4\frac{3}{8}$	$5\frac{3}{1\frac{6}{6}}$	
3iv 3vj	$2\frac{4}{8}$	$1\frac{7}{8}$	$1\frac{5}{8}$	$6\frac{5}{8}$	$5\frac{6}{8}$	$6\frac{3}{1\frac{6}{6}}$	

Bisection of the prostate was performed.

CHLOROFORM

APPENDIX.

The operation of lithotomy being occasionally prolonged and attended with some amount of shock, and the administration of chloroform in such cases requiring much care, I think it may be useful to say a few words on the subject of chloroform. It should be given to the second degree before tying up the patient ; lest danger occur from the embarrassment to respiration, resulting from the hands being fixed to the feet, and thus impeding the natural respiratory movements of the chest.

If any difficulty should be met with, and the operation consequently prolonged, it may be advisable to stop the administration of chloroform ; otherwise a very large amount may be inhaled in repeated doses, and this would be especially dangerous in the state of shock a prolonged operation produces.

If failure of the circulation and respiration should be imminent, the first remedy to be tried, and the one most generally successful, is to apply strong ammonia to the nostrils ; while at the same time the mouth should be forced open, and if the symptoms continue, a few drops of the ammonia poured into it. In these cases, if one method of restoration is not rapidly successful,

others should be quickly used in succession, such as, pulling forward the tongue, dashing cold water on the face, artificial respiration by Silvester's method, and inflation of the lungs by mouth or bellows.

The treatment by pulling forward the tongue is especially dwelt on by Mr Erichsen, who writes : —“ Lister's rules for the administration of chloroform are, to watch the respiration in preference to the pulse ; to cease administration at once when the peculiar laryngeal stertor is produced ; and if this pass on to complete obstruction of respiration, to pull the tongue *forcibly* forwards so as to cause retraction of the arytaenoid cartilages by reflex action, and not merely to bring the tip just in front of the teeth as is usually done, under the impression that the obstruction is due to the falling back of the tongue.”

Dr Richardson, in an article published at p. 90 of the ‘Lancet’ of the 15th of January, 1870, says that he is opposed to rough handling or compression of the chest, though he thinks a change of position useful, and therefore recommends that the patient should be gently rolled over on his left side. He, however, principally depends on artificial respiration by means of bellows.

If the above means fail, no delay should occur in galvanizing the phrenic nerves, as described at

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p. 575 of the 'Lancet' of the 27th of April, 1872:—"Apply the poles, one on each side, behind the posterior border of the sterno-mastoid, a little below the middle of the neck, pressure being made deeply inwards and forwards, as if to get under the edge of the muscle. As soon as an inspiration has taken place, the poles should be raised, while an assistant compresses the chest walls to imitate the expiratory movement." This process should be rhythmically continued.

It is well to be aware, as Dr Sanson has pointed out, of the great liability to the inhalation of poisonously high percentages of chloroform at high temperatures, unless proper care be exercised.

MORTALITY OF LITHOTOMY ACCORDING TO METHOD

Left Lateral Operation.—In 299 cases operated upon by myself by the left lateral operation, of which 191 were children, the ratio of deaths was 1 in 11·96.

Recto-vesical Operation.—In 185 cases, the ratio of deaths was 1 in 4·87.

Dupuytren's Bilateral Operation.—In 112 cases, the ratio of deaths was 1 in 4·00.

Supra-pubic Operation.—In 268 cases, the ratio of deaths was 1 in 3·08.

RELATIVE FREQUENCY OF CALCULUS IN
ADULTS AND CHILDREN

Statistics prove the great relative frequency of calculous affections in the young, 50 per cent. of all patients operated upon being children under fifteen or sixteen years of age: in my own experience, the proportion has been even larger than this, as shown below:—Of 1827 cases, operated upon before the introduction of lithotrity, Sir H. Thompson says 50 per cent. were children under sixteen years of age. Of 5376 cases, 48 per cent., according to Coulson, were under fifteen years of age. Of 365 cases, operated upon by myself, 219 or 60 per cent. were under sixteen years of age.

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